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80micro

A OWGII PUBLICATION

the magazine for TRS-80[®] users

Speed Demon

The 80 Micro Basic Compiler

**Model 4 Sprints!
Gets an Overhaul**

**NovaCalc: A Basic
Spreadsheet Treat**

**Thirteen Patches
To TRSDOS 1.3**

**How to Get More
From Your DMP**

Also:
The Next Step
BBS Express
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2000 Plus



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Our new Profile 4 Plus (26-1635, \$249.95) makes advanced data base management available to Model 4 owners. It's based on the same powerful system already used by Model 12 and Model 16 users. Profile 4 Plus offers you plenty of options for data manipulation, so you can personalize your filing system.

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**Model 4
Producer Version
Now Available**



The **PRODUCER**

The Professional Program Writer.

YOU CAN MULTIPLY YOUR PRODUCTIVITY WITH THIS SENSATIONAL SOFTWARE BREAKTHROUGH

Beginners can now program with no experience necessary.
Professional programmers now have a tool to save days and weeks of time.

THE PRODUCER WRITES CUSTOM PROGRAMS FOR YOU!

Why buy expensive Data Base programs that are only half effective and require the original Data Base system disk to run the finished program? The Producer is a Program Generator that can create the exact programs you want.

You don't need any previous programming experience since The Producer writes all the code for you. And when the program is finished, it runs without the support of the original Producer system disk.

What Kind of Programs Can The Producer Write?

With the Producer you can create impressive, sophisticated and functional software to manage your data. The only limit is your imagination. You can quickly and easily create programs to manage such things as mail lists, personnel records, inventory control, library catalogs, loan calculations, personal finances, and maintenance schedules.

You may never again need to buy a canned program to perform a needed task related to data storage and retrieval. The Producer can write all those programs for you, including the capacity to do all standard calculations and to generate both on-screen and printed reports. The freeform report generator even allows you to design reports on your preprinted forms.

How Does The Producer Work?

The Producer itself is a sophisticated program based on years of research and development. But The Producer was written with the end user in mind and the program generation process is quite simple.

You can begin by using a planning form designed to help you organize your program ideas. The Producer then asks you a series of simple English questions to enable those ideas to be translated into a program format. You use the computer's arrow keys and graphic characters to draw the data entry screen just the way you want it.

Then with the press of a button, the program generator takes over and does all that complex coding for you in a matter of minutes. The result is a complete program, capable of running by itself. That means your customized programs may be used independently of The Producer. (A feature not possible with Data Base creations.) You may duplicate your Producer generated programs and even sell them for others to use, without paying royalties.

How Difficult Is The Producer Process to Learn?

The Producer software package makes learning simple. An easy to follow tutorial takes you through each step of The Producer process as you sit at the computer. (This includes audio cassette tapes with the Model I/III versions.) This hands-on experience not only teaches you the process but allows you to create a program of your own design while you learn. The tutorial is all you need to get started.

Later, if you have need for more specific information, you can turn to the fully indexed Producer Reference Manual. The 200 pages of documentation cover virtually any question you may have so you will never be left guessing what to do next. The Producer package also includes a quick reference card to streamline your program operation and, should you ever need technical assistance, you may call a Producer Software technician for free counsel and trouble shooting.

Is It True That I Can Both Create and Edit At Will With The Producer?

Yes! Unlike most other program generators, The Producer gives you complete freedom to design the screen any way you wish. Experiment, rearrange, "cut and paste" between trial screens. That's the kind of versatility you get. And even after your program is complete, you can change your mind. With The Producer you can edit and refine finished programs without starting over. That's a real time saving.

What Are Some Other Outstanding Features Of The Producer?

- Our B-Tree file structure gives extremely fast access to data, allows global search and replace, data entry by batch mode and automatic file rebuilding.
- The Screen Generator is the best anywhere at any price and gives full screen control including graphics. You can add, insert, or delete, and move blocks of text on screen and between screens.
- All math calculations are supported including subtotals and global recalculations.
- The Freeform Report Generator gives you an amazing versatility to design text placement, interfield calculations, and formats. You can even print reports on your standard forms.
- The Producer package also includes a free Home Inventory program and a one year subscription to The Producer Newsletter.

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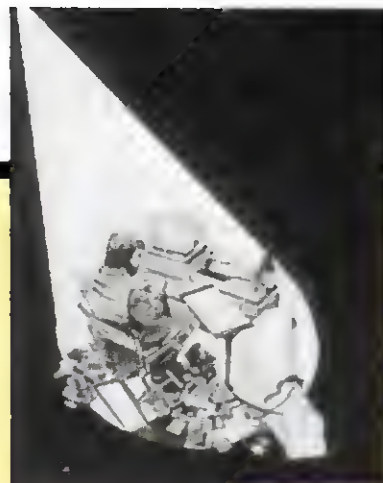
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Owning a computer program that writes programs for you may seem like a science fiction dream. But that's exactly what The Producer does. You can now enjoy professional quality programs, custom written for your specific needs!



Here's a sampling of what Producer users are saying:

"This program has paid for itself over and over." People tell us this repeatedly. First time computer users have successfully been able to generate programs with The Producer that rival the professional quality of programs available through commercial sources.

"There are only two things you need to say about The Producer: it's easy to use and it's powerful!" The woman who told us this had used several computers before but had no programming experience. Now she is saving time, money and effort by creating the programs she needs for her office.

"Owning The PRODUCER is like having a professional programmer on call-24 hours a day. I particularly like the fact that if I design a program to do a specific job today, and later discover it is inadequate to my changing needs, I can regenerate the program with corrections in a matter of minutes." That's right The PRODUCER gives you the ability to edit or expand your programs in any way you choose.

"The screen generator alone is worth the price! I created a professional data entry screen in minutes just after opening the package." With our screen generator, you are the artist and you are never locked into what someone else has designed for you.

"How did I ever live without it." This often heard quote comes from experienced programmers who are now using The Producer to generate programs in a fraction of the time it previously took to them to write programs.

"The Freeform Report Generator is an amazing feature. I never thought a product like this could give me the ability to get reports on my preprinted forms, but The Producer does it all." Yes, you can put the text anywhere on the page you want, do up to 100 interfield calculations, etc. And the Freeform is now a part of The PRODUCER package.

OTHER QUOTES FROM PRODUCER USERS

"The PRODUCER package I received was excellent. The finest software package I have ever purchased. Far beyond my expectations."

S.R. Foster, Pensacola, Florida

"I'm in love with The PRODUCER. It's one of my favorite programs."

R. Selsback, Burlingame, California

"The value of the deal, everything included, was the best I've seen to date."

G. Slusher, Martin, Kentucky

"Excellent! Above and beyond other software."

R. Hapgood, Henrietta, Texas



"The PRODUCER is the best all purpose program generator I have used. (We have tried almost all of them). The generated code is bug free, well commented and efficient."

A. Copella, Northbrook, Illinois

"This is by far my number one software and I will use it anywhere and everywhere I possibly can, both personal and in business."

R.A. Neuman, Okemos, Michigan

"The program I created with The Producer meets my needs exactly and I can change it easily as different conditions require. You can't do that with other software."

Neal Bloomenfader

"One of the best I've seen. We write about 20 volumes of material per year. Take it from a pro, it's good."

J. Crespi, Sherman Oaks, California



"Thank you for an excellent program. I agree that The PRODUCER will change the entire concept of program creation in the future. But for now, you stand as the best data base management system I can buy."

E. Sung, Vancouver, B.C.

"I think The PRODUCER will make the software hackers upgrade their products to this high level quality of the PRODUCER. I'm sure you realize that there is a lot of garbage on the market."

D.J. Smith, Lombard, Illinois

"The Producer is among the best systems I have used in ten years of professional data processing."

Dennis R. Cutshall, APO NY.

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Data Shuffler is available now for TRS-80 Models I, III, and 4. Call us to place your order for immediate shipment.

The PRODUCER

The Professional Program Writer

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80 MICRO (April, 1982)

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80 MICRO (April, 1982) said "If your drives have problems I recommend RPM before paying to get it repaired."

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THIS PROGRAM IS A MUST FOR EVERYONE WHO USES BASIC ON A TRS-80. It reduces string compression delays by 95% or more. You suffer from these delays whenever you run a BASIC program. Your computer locks up for seconds, or minutes, and you may even think it's "crashed."

TRASHMAN FIXES THE PROBLEM! As soon as you start to use it, those delays will almost disappear. The program is very easy to use, so you don't have to be a computer programmer to take advantage of it. It's written in "machine language" and uses only 578 bytes of memory for itself, plus 2 bytes for each "string" in your program. It works with other machine language programs and all the major operating systems.

IT SHOULD HAVE BEEN BUILT INTO THE COMPUTER IN THE FIRST PLACE, but since it wasn't, look at this chart, and then order your copy today.

# STRINGS	SECONDS DELAY NORMAL	TRASHMAN	PERCENT IMPROVEMENT
10	.1	.1	0
250	11.8	0.7	94
500	45.8	1.6	96.5
1000	179.5	3.5	98
2000	713.2	7.8	98.9

Note: Neither use with The Home Assembler.

"...in those programs that use hundreds of strings arrays, the time saved is outstanding." 80 MICRO, Jan. '83

Works great, had 45 sec. delays in printing, now almost no delays. D.T.

"We have installed TRASHMAN in one of our most major programs and it has reduced the run time by over one-third! A.W.L.

TRASHMAN is available on Disk for the TRS-80 Models I & III for just **\$39.95** ✓1

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18.7, 18.8, 18.9, 19.0, 19.1, 19.2, 19.3, 19.4, 19.5, 19.6, 19.7, 19.8, 19.9, 20.0, 20.1, 20.2, 20.3, 20.4, 20.5, 20.6, 20.7, 20.8, 20.9, 21.0, 21.1, 21.2, 21.3, 21.4, 21.5, 21.6, 21.7, 21.8, 21.9, 22.0, 22.1, 22.2, 22.3, 22.4, 22.5, 22.6, 22.7, 22.8, 22.9, 23.0, 23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 24.0, 24.1, 24.2, 24.3, 24.4, 24.5, 24.6, 24.7, 24.8, 24.9, 25.0, 25.1, 25.2, 25.3, 25.4, 25.5, 25.6, 25.7, 25.8, 25.9, 26.0, 26.1, 26.2, 26.3, 26.4, 26.5, 26.6, 26.7, 26.8, 26.9, 27.0, 27.1, 27.2, 27.3, 27.4, 27.5, 27.6, 27.7, 27.8, 27.9, 28.0, 28.1, 28.2, 28.3, 28.4, 28.5, 28.6, 28.7, 28.8, 28.9, 29.0, 29.1, 29.2, 29.3, 29.4, 29.5, 29.6, 29.7, 29.8, 29.9, 30.0, 30.1, 30.2, 30.3, 30.4, 30.5, 30.6, 30.7, 30.8, 30.9, 31.0, 31.1, 31.2, 31.3, 31.4, 31.5, 31.6, 31.7, 31.8, 31.9, 32.0, 32.1, 32.2, 32.3, 32.4, 32.5, 32.6, 32.7, 32.8, 32.9, 33.0, 33.1, 33.2, 33.3, 33.4, 33.5, 33.6, 33.7, 33.8, 33.9, 34.0, 34.1, 34.2, 34.3, 34.4, 34.5, 34.6, 34.7, 34.8, 34.9, 35.0, 35.1, 35.2, 35.3, 35.4, 35.5, 35.6, 35.7, 35.8, 35.9, 36.0, 36.1, 36.2, 36.3, 36.4, 36.5, 36.6, 36.7, 36.8, 36.9, 37.0, 37.1, 37.2, 37.3, 37.4, 37.5, 37.6, 37.7, 37.8, 37.9, 38.0, 38.1, 38.2, 38.3, 38.4, 38.5, 38.6, 38.7, 38.8, 38.9, 39.0, 39.1, 39.2, 39.3, 39.4, 39.5, 39.6, 39.7, 39.8, 39.9, 40.0, 40.1, 40.2, 40.3, 40.4, 40.5, 40.6, 40.7, 40.8, 40.9, 41.0, 41.1, 41.2, 41.3, 41.4, 41.5, 41.6, 41.7, 41.8, 41.9, 42.0, 42.1, 42.2, 42.3, 42.4, 42.5, 42.6, 42.7, 42.8, 42.9, 43.0, 43.1, 43.2, 43.3, 43.4, 43.5, 43.6, 43.7, 43.8, 43.9, 44.0, 44.1, 44.2, 44.3, 44.4, 44.5, 44.6, 44.7, 44.8, 44.9, 45.0, 45.1, 45.2, 45.3, 45.4, 45.5, 45.6, 45.7, 45.8, 45.9, 46.0, 46.1, 46.2, 46.3, 46.4, 46.5, 46.6, 46.7, 46.8, 46.9, 47.0, 47.1, 47.2, 47.3, 47.4, 47.5, 47.6, 47.7, 47.8, 47.9, 48.0, 48.1, 48.2, 48.3, 48.4, 48.5, 48.6, 48.7, 48.8, 48.9, 49.0, 49.1, 49.2, 49.3, 49.4, 49.5, 49.6, 49.7, 49.8, 49.9, 50.0, 50.1, 50.2, 50.3, 50.4, 50.5, 50.6, 50.7, 50.8, 50.9, 51.0, 51.1, 51.2, 51.3, 51.4, 51.5, 51.6, 51.7, 51.8, 51.9, 52.0, 52.1, 52.2, 52.3, 52.4, 52.5, 52.6, 52.7, 52.8, 52.9, 53.0, 53.1, 53.2, 53.3, 53.4, 53.5, 53.6, 53.7, 53.8, 53.9, 54.0, 54.1, 54.2, 54.3, 54.4, 54.5, 54.6, 54.7, 54.8, 54.9, 55.0, 55.1, 55.2, 55.3, 55.4, 55.5, 55.6, 55.7, 55.8, 55.9, 56.0, 56.1, 56.2, 56.3, 56.4, 56.5, 56.6, 56.7, 56.8, 56.9, 57.0, 57.1, 57.2, 57.3, 57.4, 57.5, 57.6, 57.7, 57.8, 57.9, 58.0, 58.1, 58.2, 58.3, 58.4, 58.5, 58.6, 58.7, 58.8, 58.9, 59.0, 59.1, 59.2, 59.3, 59.4, 59.5, 59.6, 59.7, 59.8, 59.9, 60.0, 60.1, 60.2, 60.3, 60.4, 60.5, 60.6, 60.7, 60.8, 60.9, 61.0, 61.1, 61.2, 61.3, 61.4, 61.5, 61.6, 61.7, 61.8, 61.9, 62.0, 62.1, 62.2, 62.3, 62.4, 62.5, 62.6, 62.7, 62.8, 62.9, 63.0, 63.1, 63.2, 63.3, 63.4, 63.5, 63.6, 63.7, 63.8, 63.9, 64.0, 64.1, 64.2, 64.3, 64.4, 64.5, 64.6, 64.7, 64.8, 64.9, 65.0, 65.1, 65.2, 65.3, 65.4, 65.5, 65.6, 65.7, 65.8, 65.9, 66.0, 66.1, 66.2, 66.3, 66.4, 66.5, 66.6, 66.7, 66.8, 66.9, 67.0, 67.1, 67.2, 67.3, 67.4, 67.5, 67.6, 67.7, 67.8, 67.9, 68.0, 68.1, 68.2, 68.3, 68.4, 68.5, 68.6, 68.7, 68.8, 68.9, 69.0, 69.1, 69.2, 69.3, 69.4, 69.5, 69.6, 69.7, 69.8, 69.9, 70.0, 70.1, 70.2, 70.3, 70.4, 70.5, 70.6, 70.7, 70.8, 70.9, 71.0, 71.1, 71.2, 71.3, 71.4, 71.5, 71.6, 71.7, 71.8, 71.9, 72.0, 72.1, 72.2, 72.3, 72.4, 72.5, 72.6, 72.7, 72.8, 72.9, 73.0, 73.1, 73.2, 73.3, 73.4, 73.5, 73.6, 73.7, 73.8, 73.9, 74.0, 74.1, 74.2, 74.3, 74.4, 74.5, 74.6, 74.7, 74.8, 74.9, 75.0, 75.1, 75.2, 75.3, 75.4, 75.5, 75.6, 75.7, 75.8, 75.9, 76.0, 76.1, 76.2, 76.3, 76.4, 76.5, 76.6, 76.7, 76.8, 76.9, 77.0, 77.1, 77.2, 77.3, 77.4, 77.5, 77.6, 77.7, 77.8, 77.9, 78.0, 78.1, 78.2, 78.3, 78.4, 78.5, 78.6, 78.7, 78.8, 78.9, 79.0, 79.1, 79.2, 79.3, 79.4, 79.5, 79.6, 79.7, 79.8, 79.9, 80.0, 80.1, 80.2, 80.3, 80.4, 80.5, 80.6, 80.7, 80.8, 80.9, 81.0, 81.1, 81.2, 81.3, 81.4, 81.5, 81.6, 81.7, 81.8, 81.9, 82.0, 82.1, 82.2, 82.3, 82.4, 82.5, 82.6, 82.7, 82.8, 82.9, 83.0, 83.1, 83.2, 83.3, 83.4, 83.5, 83.6, 83.7, 83.8, 83.9, 84.0, 84.1, 84.2, 84.3, 84.4, 84.5, 84.6, 84.7, 84.8, 84.9, 85.0, 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On the Cover

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Learn the true meaning of speed with this revamped version of 80's Basic compiler. (Models I and III; Load 80)
- 60. Model 4 Scripsit the Write Way** by Clifford Knight
Boost the power and convenience of Model 4 Scripsit with this complete package of enhancements. (Model 4; Load 80)
- 82. NovaCalc** by Daniel Garms
Why pay for the higher-priced spread? This full-featured spreadsheet is yours for the taking. (Models I and III; Load 80)
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Create custom graphics characters with your Radio Shack dot-matrix printer. (Models I, III, and 4; Load 80)
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Thirteen patches to mend the holes in TRSDOS 1.3. (Model III)

Features

- 106. On the Record** by Jane Goodale
Indexed random-access files give you the benefits of direct access without wasting space. (Models I and III; Load 80)
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LOAD 80

Load 80 gathers together selected programs from this issue of *80 Micro* and puts them on a magnetic medium for your convenience. It is available on tape or disk, and runs on the Models I, III, and 4.

If you own a tape system, load the Load 80 tape as per the instructions provided. If you own a Model I or III disk system, boot the Load 80 disk and transfer the files to a TRSDOS system disk according to simple on-screen directions. If you own a Model 4, you must convert the

programs from Model III TRSDOS to Model 4 disk using the Model 4 CONV command.

Not all programs will run on your system. Some Model III programs, for instance, will run on the Model 4 in the Model III mode, but not in the Model 4 mode. You should check the key box that accompanies the article to find out what system configuration individual programs require.

If you have any questions about the programs, call Keith Johnson at 603-924-9471. Yearly subscriptions to Load 80 are \$199.97 for disk, or \$99.97 for cassette. Individual loaders are available on disk for \$21.97 or on cassette for \$11.47, including postage. Direct subscription problems or orders for Load 80 to Lori Eaton, c/o *80 Micro*, 80 Pine St., Peterborough, NH 03458.

Directory

FastBas

Article: Running Like the Wind (p. 42)
System: Models I and III, 32K RAM,
Language: Basic

An updated version of *80 Micro*'s Basic compiler.
Cassette filespec: B, C, D, E
Disk filespec: FASTBAS/BAS, LIST2/BAS, LIST3/BAS, PONG/BAS.

ScriptAid

Article: Model 4 Scriptit the Write Way (p. 60)
System: Model 4, 64K RAM, one disk drive.
Language: Assembly/Basic

An enhancement package for Model 4 Scriptit. Disk filespec: ENHANCE/OVL (system), REKEY/OVL (system), PRTRDRIVE/BAS, HELPBUD/BAS. Requires editor/assembler.

NovaCalc

Article: NovaCalc (p. 82)
System: Models I and III, 48K RAM, one disk drive.
Language: Basic

A Basic spreadsheet program.
Disk filespec: NOVACALC/BAS.

Graphics

Article: Picture Perfect (p. 98)
System: Models I, III, and 4, 16K RAM.
Language: Basic

Create your own graphics characters on your Radio Shack dot-matrix printer.
Cassette filespec: J, K, L, M, N, O, P.
Disk filespec: GRAPAPER/BAS, CHARGEN1/BAS, CHARGEN2/BAS, STRINGS3/BAS, SUBGRAF4/BAS, SUBGRAF5/BAS, SUBGRAF6/BAS.

Random Files

Article: On the Record (p. 106)
System: Models I and III, 32K RAM.
Language: Basic

Three programs that create and read random-access disk files.
Cassette filespec: G, H, I.

Disk filespec: RANDISKU/BAS, RANDISK1/BAS, LOOKDISK/BAS.

Cubic

Article: Formula Solutions (p. 116)
System: Model I and III, 16K RAM cassette, 32K RAM disk; Models 4, 1000, 1200, 64K RAM, one disk drive.
Language: Basic

Programs for solving cubic, quadratic, and linear equations.

Cassette filespec: Q, R.
Disk filespec: CUBIC1/BAS, CUBIC3/BAS, CUBIC4/BAS.

Interrupt

Article: Project 80 (p. 120)
System: Models III and 4, 16K RAM
Language: Assembly

Demonstration program: How to use the 8259A interrupt controller with the Project 80 general-purpose I/O board.
Cassette filespec: INTRPT (source code). Requires Apparat editor/assembler.
Disk filespec: INTRPT/SRC (source code). Requires Apparat editor/assembler.

BBS

Article: BBS Express (p. 132)
System: Model III, 48K RAM, two disk drives.
Language: Assembly/Basic

A routine for locating message numbers.
Cassette filespec: BBS1/(source code), S.
Source code requires editor/assembler.
Disk filespec: BBS1/SRC (source code), BBS2/BAS. Source code requires editor/assembler.

Demo

Article: The Next Step (p. 140)
System: Model III, 32K RAM, one disk drive.
Language: Assembly

Demonstration program to create a beep generator.
Cassette filespec: DEMO1, DEMO2, DEMO3 (all source code).
Disk filespec: DEMO1/SRC, DEMO2/SRC, DEMO3/SRC (all source code). Requires Apparat Editor/assembler.

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Tandy Charts a New Course

I've recently heard some complaints from long-time TRS-80 owners that Tandy is selling out by stepping into the MS-DOS market. They're disgusted by what they see as a "me-too" philosophy, and nostalgically think back to the Model 1 days when Tandy was a pioneer in the industry.

I have to disagree. The Models 1000, 1200, and 2000 do not indicate a sell-out, but a recognition by Tandy that it cannot survive, let alone thrive, outside the mainstream.

It's easy to get sentimental about the Model 1. But this sentimentality has clouded some people's perceptions of Tandy's role in the microcomputer market. They think that because Tandy was one of the first, it therefore should be at the forefront of new and creative technology.

History says otherwise. Through the years, Tandy's success has depended on effectively packaging proven technologies. It has shown a remarkable propensity for cashing in on whatever electronic consumer product happens to be hottest. It did so with stereos. It did so with CBs. And most recently, it is doing so with telephones.

In all cases, Tandy's strategy was to make an inexpensive product, sell it by the truckload through its Radio Shack retail chain, and provide convenient after-sale support. The company's method for selling computers is essentially the same.

You could argue that at some point in the distant past, Tandy could have aggressively established its Z80 computers and TRSDOS operating system as de facto industry standards, as Apple and IBM eventually did with their products. But that would have been asking the company to be something it was not.

Staying with its proprietary DOS would spell the end of Tandy as a microcomputer manufacturer. It would be like selling stereo systems that don't play 12-inch records. So let's not



mourn the decline of the Z80 computer, but instead be thankful that Tandy had the good sense to join the rest of the world.

1985—The Comeback Year?

1985 could very well be the most important year in Tandy's history, for it will reveal whether the company can reestablish itself as a vigorous participant in the microcomputer marketplace. The three key factors are how well the Model 1000 does, how well Model 4 sales hold up, and how well Tandy can impress itself on the consciousness of the buying public.

My gut feeling is that the 1000 is going to do well. This is the type of machine Tandy does best: inexpensive and expandable. The company should sell a good many just to its current user base. Model 1/III and Color Computer owners in particular should see the Model 1000 as their chance to enter the MS-DOS market at a reasonable price. If Tandy can also reach businesses that want a cheap alternative to an IBM PC or want to add to their current installment of PCs, the 1000 could become the company's all-time best seller.

How quickly the 1000 market develops is another matter. This is where the Model 4 comes in. Tandy must continue to sell the system during the

transition to MS-DOS. To do so, it must sell the machine creatively, by further reducing the price, bundling software, and adding enhancements. (For instance, the company might extend the 4's life if it could get Zilog's 16-bit Z800 in quantity.)

Lastly is marketing, which in Tandy's case means getting more visibility. The issue of Tandy's image has been beaten to death with a tire iron, and rightfully so. The Model 1000 is Tandy's chance to put all that criticism to sleep.

Tandy is finally realizing that selling TRS-80s is not the same as selling stuffed-animal radios and batteries. The computer marketplace is highly competitive, and exposure is critical. Unfortunately, Tandy's machines do not get the shelf space, and therefore the visibility, in retail stores that other systems do.

The beauty of the 1000 is that it can create its own visibility. While the machine won't be in non-Radio Shack retail stores, its software will. Furthermore, computer magazines will have to reckon with the 1000 when discussing MS-DOS machines and IBM clones. All Tandy needs to do is prime the pump with an intelligent advertising and promotion campaign.

Marketing the Model 4, on the other hand, is going to present problems. It has become *machina non grata* in the computer industry. Take, for instance, a recent cover article in *Personal Computing* comparing the Apple IIc and the IBM PCjr. The 4 is lumped with the Kaypro in a couple of throwaway lines, and dismissed as having "inferior graphics/color capabilities, very little entertainment or educational software and very little expandability." Considering the 4's price, power, and software base, it deserves more respect.

All in all, Tandy has reason to be guardedly optimistic. If it plays its card right, this could be the year the company makes its comeback. ■

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Our print samples were done on an Epson. Sizes vary on other printers. Some of the samples shown here are taken from the additional Letterset disks.

Two disk drives and at least 48K of memory are required. LDS is not available in native Model 4 mode.



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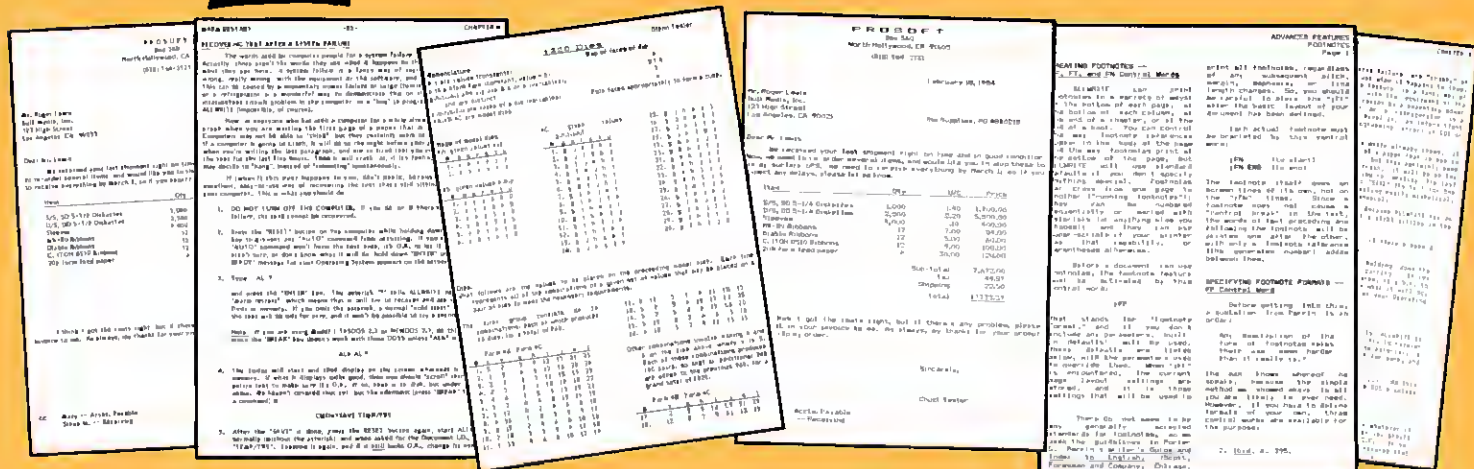
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These were printed by ALLWRITE; shown 20% actual size.

wasting time printing all the text. These standard features make document preparation faster and easier than ever!

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There is no upper-limit on document size with ALLWRITE, because it chains files backwards as well as forwards, even across diskettes. Switch from one chained file to another in less than six seconds by pressing two keys. Select portions of other files for inclusion at print time...great for stock paragraphs.

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The model 4 version of ALLWRITE uses the entire 80-by-24 screen. On a 64K machine, you can edit over 34,000 characters of text. On a 128K machine, you can edit **THREE FILES AT THE SAME TIME!** The second and third files can be over 32,600 characters each, for a total of **almost 100,000 characters** of text in memory.

and then show you where the lost text belongs. This advanced error recovery turns a disaster into a feeling of profound relief.

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You can store 22 phrases or commands at a time into "soft-keys," then press just two keys to retrieve them. This makes frequently-used phrases and formatting controls a *snap* to use. You can store these definitions on disk and build a library of hundreds of pre-programmed keys to fit every one of your applications.

Our specially-designed templates fit right on your keyboard to let you see your settings at all times. Each template is also a Reference ("Cue") Card, so it is always right in front of you when you need it, without using up valuable screen space.

ALLWRITE Is Easy To Learn

ALLWRITE's commands and control keys are easy to remember because they use the first letters of common English words: 'CE' stands for 'Center,' 'Search' and 'Replace' do just that, and so forth. The on-line HELP menu offers over fifty screens of topics.

NEWSSCRIPT's documentation was acclaimed in every review, and ALLWRITE's 350-page book is even better. Portions of it are designed for beginners, with every feature clearly explained in step-by-step tutorial style. Since you won't always be a beginner, other parts of the book offer advanced topics. There is a cross-reference summary chapter, a 14-page comprehensive index, and a detailed Table of Contents. We've been developing computer programs and manuals for over 20 years, and understand the importance of good documentation.

To make installation easy, we include Tiny DOSPLUS for the Models I and III, and special, pre-tailored versions of both TRSDOS 6.2 and DOS-PLUS IV for the Model 4, all at no extra charge. The Model I and III versions work equally well with all major DOS's.

PROSOFT'S On-Going Customer Support

Perhaps the best reason of all for having ALLWRITE is the continuing support we offer you: friendly, expert, direct support that is unsurpassed in the micro-computer industry. There is no time limit to our support: if you are our customer and you need help, just call or write. We give free updates for 90 days, and charge little or nothing for minor updates thereafter.

Customer Comments

"This is the best software package I have ever received...superb, easy to use, fast, and has more features than the business word-processor at the office." (E.R.L.)

"ALLWRITE is a professional system that sets a new standard in word processing. It's powerful and easy to learn and use."

80 MICRO, Nov., 1984

"Your company and products have to be one of the strongest factors I can think of for keeping me with the TRS-80!" (J.R.H.)

"NEWSSCRIPT is the Cadillac of word processors. ALLWRITE is the Mercedes Benz!!" (B.E.)

"...a very readable manual." (D.S.)

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NICE Perspective

I found R. Walter Steur's review of NICE (October 1984, p. 39) shallow and overly negative. Steur ignores the fact that NICE is one of the most flexible and versatile TRS-80 packages available.

NICE isn't perfect; its documentation, for example, leaves much to be desired. Yet, when considering its performance and capabilities, I think NICE deserves a four-star rating.

Michael R. Keller
Skowhegan, ME

Where's The Disk?

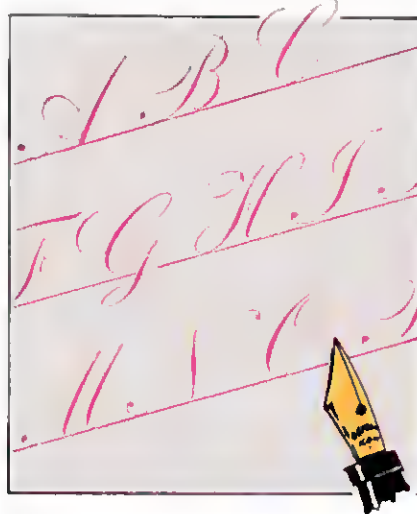
Contrary to what's stated in Table 1 of Hardin Brothers' "Making Your Selection: Choosing the Right Editor/Assembler" (September 1984, p. 60), Radio Shack's Series I Editor/Assembler includes only the Model III disk in its package. In place of the Model I disk that I wanted were instructions for exchanging the enclosed disk for a Model I disk. If it's the Model I disk that you're after, I advise that you open the package before buying the product.

G. F. Mueden
New York, NY

Communicating

I disagree with what M. J. Batham refers to as "drawbacks" in her review of Videotex Plus (September 1984, p. 168). First, hex codes are required only if you use the SETCOM feature on an automatic log-on. If you use the clear-Q keys to configure the program, you're presented with a chart of baud rates or UART configurations. Then, all you have to do is select the number conforming to the baud rate of the desired configuration.

Secondly, Batham states that you can't go back into DOS without logging off or redialing the host computer. I do this all the time; just exit using clear-X, and then reload Videotex Plus. You will, of course, lose



information sent by the host computer while you're out of Videotex Plus.

Finally, control-P doesn't send the signal that prints the contents of the buffer; rather, it sends a control-P to the host computer. It's clear-P that prints what's contained in the buffer.

L. J. Kuttan
St. Louis, MO

The inaccuracies in M. J. Batham's review of Videotex Plus can't be ignored. The program is capable of generating a true break signal; p. 23 of the User's Guide and the on-screen help menu both state that the F3 function key generates this.

You turn on the printer with clear-or control-R, while clear- and control-P is sent to the RS-232 board. In addition, Videotex Plus doesn't support XMODEM protocol, but instead supports CompuServe's B protocol.

Adam Rubin
Wappingers Falls, NY

In reviewing Videotex Plus, I tested the program extensively using the Model 4 to communicate with CompuServe and a local IBM-type BBS. Hex codes are required to use Videotex Plus's auto log-on feature. Pages 8-11 of the manual explain how to input hex codes, yet it's confusing to a user who doesn't know hex.

The only way to return to DOS is to

exit the program which, in turn, makes you lose information from the host computer. Other telecommunications programs allow a return to DOS while capturing data in the buffer.

Control-P on my version (1.00.00) toggled the printer, allowing it to print the contents of the buffer. Page 25 of the manual explains the clear-P option to print the buffer contents. The use of both P and R are similar, with R acting as a print screen function, and P as a print buffer option.

Adam Rubin is correct in stating that the F3 key generates a break, yet the break key doesn't initiate a true break. When following the instructions on p. 31 of the manual, I had no difficulty with file transfer using the XMODEM protocol. In doing this, I also used the No option to turn off the XON/XOFF support.

M.J. Batham
Des Plaines, IL

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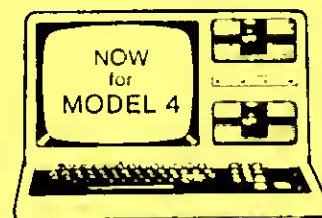
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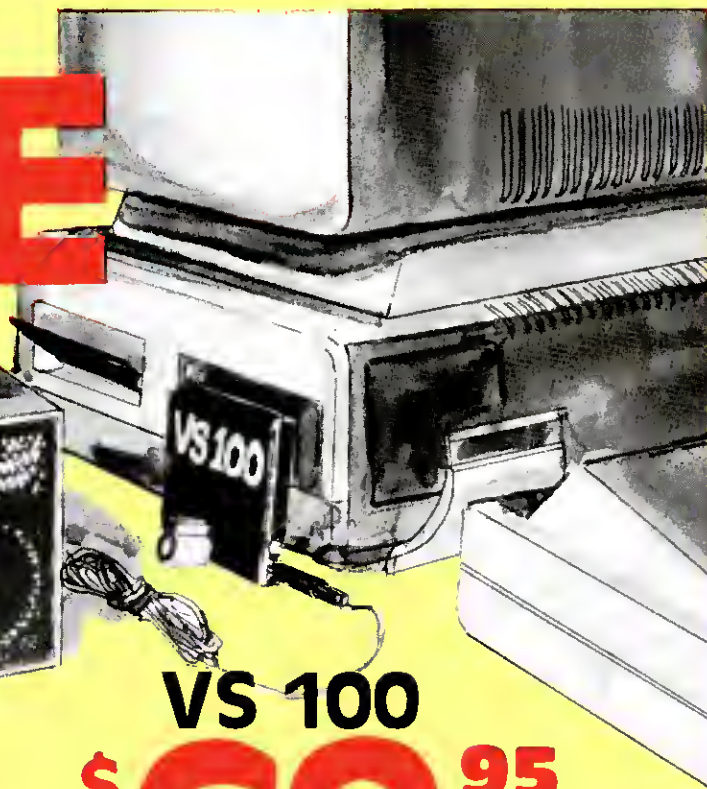
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Q: I've been helping a friend upgrade his Model I from 16K to 48K. He's had problems with the Model I's random-access memory and I was thinking of speeding up the RAM-refresh signals. Dennis Kitz, in *The Custom TRS-80*, says "locate Z69, and cut the trace running from pin 5 to pin 12. Connect pin 12 to pin 13. This speeds the memory-select process (from MREQ and RD) just a tad."

However, an old 80 Micro Exclusive Oracle column says "Find Z89, locate the circuit trace running from pin 5 (it runs back underneath Z69). Cut that trace. Jumper pins 10 and 12 of Z69 with a short piece of wire." I figure one of them must be right. I'd appreciate it if you could tell me which one.

Also, what is Dennis' full address? I have no street address, and my post office says it can't deliver a letter without one. (Steven Maguire, Port Richey, FL)

A: Not to worry; the two methods are electronically equivalent. The first is slightly more reliable. Both generate the memory-select signal a cycle ahead of design, giving the memory more time to react and deliver data.

Your post office people are naive. Dennis Kitz' complete address is Roxbury, VT 05669. When the total population of a town is about 100, street addresses are superfluous.

Q: An LNW ad on the back of 80 Micro says that the Team computer is compatible with Radio Shack's Models I, III, and 4. How compatible is compatible? I've had



quite a few problems with my Model III due to lack of cooling and/or ventilation. Also, I'm at the point where I need the added capabilities of a machine like the LNW. So overall, how would you rate the Team?

I use Cobol and SuperScript with TRSDOS 1.3 and I want to move them to DOSPLUS 3.5 (or 4.0 if I get the LNW). How can I do this without knowing the passwords? I have patches from MicroSystems to make them work under DOSPLUS, but how do I move the programs?

Finally, when I write (in Cobol) to a DMP-2100 printer, the underline feature turns on and I have to turn off the printer to reset it. Can you or anyone else help me with this one? (Rick C. Chandler, Brentwood, TN)

A: Get a cooling fan for your Model III. Radio Shack sells muffin fans that'll do the job. If you want something a bit more attractive, look for a 4-inch box fan at a local electronics store. It shouldn't cost more than about \$20.

Model I/III/4 software seems to be better than 90 percent compatible with the LNW. I can't give an opinion on the computer as I haven't seen it.

As for the passwords for SuperScript and Cobol, MicroSystems should be able to give them to you, or tell you how to get the job done. I be-

lieve their Transfer utility will move the program by ignoring the passwords and protection levels, but the programs will still have these attributes on the new disks. Check your manual for more information.

I don't know what to suggest for your printer problem except doing a dummy write, turning off the printer, resetting the underline, and continuing with the job. Try looking up the underline codes in the DMP-2100 manual and sending the turnoff code in a Write command.

Q: I have a 48K, dual-drive Model III on which I use Scriptit to write novels. I desperately need more RAM. Is there a way to increase the RAM in my machine? Do you know of a patch that adds underlining to Scriptit?

Second, are you familiar with Holmes Engineering's Sprinter Three? Does it work? What, if any, problems are associated with it? (Howard Davis, Vail, CO)

A: Unfortunately, you can increase the amount of available RAM, but Scriptit won't recognize it. If the buffer space is inadequate for the file size you're using, I suggest that you get a new word processor such as Newsprint, which lets you chain individual buffers into one long printed manuscript. Acorn Software's SuperScript program patches Scriptit to add features like underlining and boldface. You can order the package from Acorn at 634 N. Carolina Ave. S.E., Washington, DC 20003, 202-544-4259; \$50.

Sprinter Three speeds up CPU operation. Cassette and disk I/O automatically slow down to normal CPU speed to maintain compatibility with other Model IIIs. You can increase CPU clock speed by 50 percent; increases of 100 and 150 percent are possible but you might have to replace some of your computer's integrated

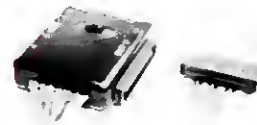
Newclock-80 \$69.95

The right time at the right price! Keep the time and date with quartz accuracy, even when your computer is off. The backup lithium battery (included) will last for over 2 years. Software on tape or disk, please specify. Use "TIMES" once to set the clock. Use "SETCLK" to set your computer's internal clock (at power up) or use "TSTRING" so that the "TIMES" function reads the Newclock. Connection: Model I: plugs into the keyboard or expansion interface. Model III: plugs into the 50-pin I/O bus. Compatible with all operating systems.



Printswitch \$59.00

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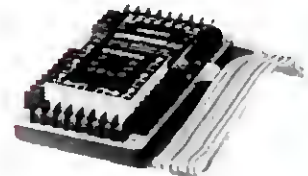
Alpha Joystick \$27.95

When it's time for fun, don't be without your Alpha Joystick. Do you know that most action games are Joystick compatible? Stop pounding on your keyboard and enjoy real arcade control. The joystick can also be used with BASIC programs; simply do J=INP(0) to read the joystick position (8 directions and fire button). Model I: plugs into keyboard or expansion interface. Model III, 4 and 4P: plugs into 50-pin I/O bus. The Alpha Joystick comes fully assembled and tested. ready to plug in and enjoy. (Specify Model I, or Model III, 4).



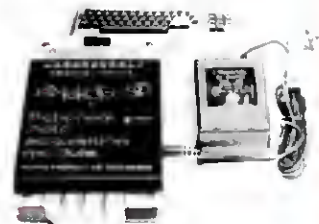
Interfacer-80 \$159.00

Low cost input and output device. The outputs consist of 8 relays (rated 2 Amp @125V), easily controlled using "OUT" commands. For example, OUT 0.0 turns all the relays off. Eight LED's show the states of the relays. The 8 Inputs are optically isolated, so it's safe and easy to connect external devices (switches, sensors, thermostats, etc.). Simple "INP" commands read the inputs. Connection: Mod I: 40 pin bus. Mod III, 4, 4P: requires 50-pin I/O bus converter (\$39.95) plugs into 50-pin I/O bus. Comes complete with power supply, cable, and detailed manual. (Up to 8 interfacers can be connected to your TRS-80 using our Y- cables).



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Y-Cable for Mod I bus (40 pin): • X2-40...\$29 • X3-40...\$44 • X4...\$59 • X5...\$74

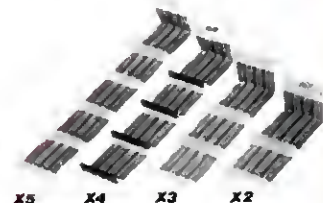
Y-Cable for Mod 3 & 4 bus (50-pin): • X2-50...\$34 • X3-50...\$49 • X4-50...\$64

Disk drive cable (34 pin): • 2-drive...C162:\$32 • 4-drive...C163:\$45

Extension cable, 4 foot: • For printer and drive (34-pin)...C165:\$22

• For Mod I bus (40-pin)...C167:\$24 • For Mod 3 & 4 bus (50-pin)...C169:\$28

Keyboard to E/I (40-pin, 8")...C161:\$21 If this is confusing, send for our Cable Flyer. Our cables are made with high quality gold plated connectors to ensure utmost reliability.



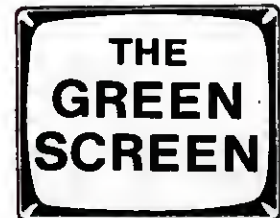
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FEEDBACK LOOP

circuits (memory and associated chips) with higher quality chips.

Q: I have some comments about Model 4 software. I recently purchased CP/M+ from Radio Shack, and my biggest complaint is that a number of files are missing.

My Model 4 has double-sided drives. The CP/M+ manual provides instructions for reconfiguring the Basic input/output system (BIOS) and Basic disk operating system (BDOS). The only problem is that the CP/M+ package lacks the necessary BIOS or BDOS files. When I requested help, Radio Shack told me that it wasn't going to support CP/M+ and that I'd have to go to Digital Research to get the necessary files.

I also requested help with installing Wordstar 3.0. CP/M+ is configured to be a DEC VT52 terminal, but the installation program doesn't include a configuration file for this terminal. I finally bypassed the problem by installing Wordstar as a Heath HI9/H89 terminal, which is DEC VT52-compatible.

I configured my system to use the click filter, which produces a noise each time you press a key. The click filter conflicts with SuperScript. I asked the computer service rep at the local Radio Shack if there were any patches to get around the problem. After two weeks, I was told that the two programs conflict and that I'd have to turn off the filter when using SuperScript. I already knew this. *(Gerald Crosby, Columbus, OH)*

A: Thanks for writing. Does anyone know of a patch that takes care of the SuperScript problem?

Q: Regarding Christopher Jensen's question about using Enhanced VisiCalc on the Model I (April 1984, p. 14): Logical Systems Inc., maker of LDOS, has a patch that lets you run Enhanced VisiCalc on both the Models I and III. It works under LDOS or SmallDOS. The patch is public domain and comes on a disk of patches called the Fix Disk. The disk is \$10; you can reach Logical Systems at P.O. Box 23956, Milwaukee, WI 53223, 414-355-5454. *(Robert M. Connors, APO NY)*

A: If it isn't too much of an expense, readers should get LDOS when they want to use Model

III software on a Model I. They'll also have to buy a double-density modification (and most Model III software requires the additional drive space available with double density) but that's still cheaper than a new Model 4.

Q: I recently bought a secondhand Model III and took it home in my car. When I tried to call a directory for the drive 1 disk, I got an error message (data lost during disk I/O). I had Radio Shack align both drives, which cost me \$60, but the problem returned after a week. Radio Shack fixed the drives again, at no charge.

The computer worked fine for two months. Then I took it to work in my car, and it did it again. I have a sneaky feeling that the ride in my car is shaking the computer and moving the drives out of alignment. Is this possible? Is there a special disk I can use to protect the drives when transporting the computer; if not, can I realign the drives myself? *(Dorothy Belk, Little Rock, AR)*

A: The problem is definitely vibration, but your drives shouldn't be that sensitive. I suspect that the alignment screw is a bit loose in its fittings. If you must move the computer around, get the Disk Drive Analyzer from J & M Systems (137 Utah NE, Albuquerque, NM 87108, 505-265-1501; \$79 for single-sided drives) so you can test your drives. This program and disk are the next best thing to having a professional technician with an oscilloscope look at your drives.

Q: I've been having problems saving longer programs on my Radio Shack Series I Editor/Assembler. Could it be the computer or tape recorder? Is there a limit to the size of a file the editor/assembler can save? The manual doesn't mention any such limitations. *(Rodney Maglente, Chicago, IL)*

A: Series I is limited to a maximum file size of 211 lines (note that the limit is lines, not memory). If you're having problems with files smaller than that, I suspect that the tape recorder head is drifting as you're writing or loading a file, but that should give you some type of error message when the file fails to load properly. If you aren't getting the er-

ror message, I'm stumped. Does anyone else have ideas or comments?

Q: Here's an additional suggestion for Don Schenbarger (March 1984, p. 15) regarding the "Diskette?" prompt. If the cable from the disk drives' controller board to the CPU board doesn't make good contact, the prompt can appear, so the problem could be hardware related.

I'd like to know the relationship between Model I Scripsit and my version, 3.2. Craig Lindley's patch program for Model I Scripsit (October 1982, p. 276) doesn't work with my version. Does Scripsit 3.2 occupy different memory locations? Is there a disassembled listing of version 3.2 available so that I can install some of the patch functions?

Also, would you recommend a good disassembler program for the Z80A as used in the Models III and 4? I'm interested in one that converts machine hexadecimal code into symbolic or mnemonic code. *(Stephen A. Torkko, North Bend, OR)*

A: Patches for programs on the Model I invariably don't work on Model III versions of the same program. The problem is that disk and printer I/O routines are almost totally different. If you want patches that make Scripsit much easier to use, try Acorn's Superscript. For more information, see my answer to Howard Davis' letter above.

I don't know of any disassemblies of Scripsit 3.2 you could buy. Can anyone else help? I'm not familiar enough with the disassemblers currently on the market to make a suggestion.

Q: I have a late-issue Model I with an RS Expansion Interface, for which I bought double-sided drives (Tandon TM-100-2). To date, I've been unable to access the second side. My DOSPLUS 3.5 and LNW 5/8 doubler perform flawlessly as long as I've configured only one side. I run into problems when I try to generate a double-sided master of DOSPLUS. I've tried several copies of DOSPLUS and even had the SYSGEN utility replaced, suspecting it was at fault. I feel that I have some kind of hardware problem, and that the computer isn't physically accessing the second side. Any suggestions? *(Chuck Fullgraf, Aiken, SC)*

A: To the best of my knowledge, DOSPLUS 3.5 works with double-sided drives. Before you try SYSGENing the system disk, use the CONFIG command to access the second drive as a double-sided drive. Once DOSPLUS knows that the second disk has two sides, you should be able to verify and use both sides of any disk in that drive. Don't forget that you have to use double-sided disks; single-sided disks won't format as double-sided unless you've altered them properly.

As soon as you finish with the CONFIG command, format a double-sided disk. If the second side fails to verify, check the configuration of your system and make sure that the disk in drive 1 reports as being double-sided. If it is, and you still can't format both sides of a disk, you definitely have a hardware problem.

Call LNW to make sure your doubler supports double-sided drives. Then check with MicroSystems Software and see if you're doing anything wrong with the CONFIG command, and ask for advice. Finally, take your drives to a technician and have them checked out; they might have a jumper that needs to be set, or some other such silliness.

Once you get DOSPLUS working on both sides of your second drive, you can then SYSGEN a master DOSPLUS disk for use in drive zero.

Q: I bought a Model 4 from Displayed Video, but I didn't receive a TRSDOS 6.0 registration card. How do I get one? Can I expect TRS-80 equipment from dealers like Displayed Video to be equal in quality to all-Radio Shack equipment?

Also, is there a way to solve the problem of losing characters when words wrap around in SuperScript? Do any software companies offer modifications to SuperScript? The features I have in mind are indexing, footnoting, and so on. Since software firms seem to be advertising less in magazines like *80 Micro*, where can I learn about new programs for the Model 4?

Finally, why can't I directly transfer files between a Model 4 and a Model 100 via the cassette interfaces? Is it absolutely necessary to have an RS-232C interface? (Hugh Ruppensburg, Athens, GA)

A: Only Tandy gives out registration cards, but you're in luck. Tandy just released TRSDOS 6.2. If you go to a local Radio Shack store and ask for the updated DOS, you should get a new registration card with it. And they shouldn't charge you for the update.

Buying from third-party companies that provide their own memory and drive upgrade is a *caveat emptor* situation. Usually you get equipment equal in performance to standard Tandy devices, but that's not a guarantee. Sometimes you'll get equipment superior to Tandy's. Rarely will you get inferior equipment, but it's possible. In 99 percent of the cases, as long as you stay within the normal operating specifications of a standard Model 4 (that is, don't try to add speed-up kits, super-high-density drives, etc.) you won't be able to tell the difference between standard and non-standard Model 4's.

I haven't heard of any solutions for SuperScript's losing characters during wraparound, and I don't know of any companies selling patches or enhancements for the Model 4 version. To find out about new software, check the New Products section of this magazine. If you're looking for a word processor with automatic indexing and table-of-contents capability, give Prosoft's Allwrite serious consideration (for a review, see p. 35 of the November 1984 *80 Micro*).

While the Models 4 and 100 use the same techniques and baud rates to save data to tape, there's one big difference: The Model 100 saves a title before the data, and the Model 4 doesn't. The Model 100 rejects Model 4 tapes because they aren't identified by a title, and the Model 4 rejects Model 100 tapes because the computer requires a line number before the title. You need a machine-language routine that creates a title when saving programs from the Model 4, or one that ignores the disparities in the files when you're loading from one machine to the other.

Q: I've had the same problem as Robert Goodman (April 1984, p. 16) with the automatic 60-line count in Basic. If he begins each print series with a PRINT CHR\$(28), the auto line count will reset to zero. (Galen F. Tustison, San Marcos, CA)

A: In other words, before starting a print job, line up the paper to the top of the page, send a CHR\$(28) to the printer, then start printing. Now the six-line skip will occur at the page perforations, making for a clean print-out. Thanks for the advice.

Q: Does anyone know where I could beg, borrow, or steal a Micro Design MDX-2 expansion interface board? Micro Design has discontinued it. I'll accept a slightly used or damaged board, but I'd prefer a board in its case, with the complete set of manuals. (Steve Winokur, Hershams, PA)

A: All right, folks: Does anyone out there know where Steve can get an MDX-2 board?

Q: I'm looking for Forth for my Tandy 2000. Laboratory Microsystems Inc. of Marina del Rey, CA, has a package, but it's based on the 8086 microprocessor. I've read that the 2000's 80186 has the 8086 instruction set in it, and therefore Forth should execute. Is this true? Also, does the 2000 have a math coprocessor included, or can I use the 8087-3? Better yet, do you know of a version of Forth written specifically for the Tandy 2000? Is Microsoft planning to publish one for its MS-DOS system? (Ron Watkins, Tucson, AZ)

A: Yes, 8086 Forth will run on the Tandy 2000, but you must make sure you have a version designed for that computer. Just as you can't run Z80 SuperScript on every Z80 computer, you can't run 8086 Forth on every 80186 computer. The program must be customized to use the computer's keyboard, video, and disk drives.

Before investing in a commercial program, try contacting Forth Inc., 2309 Pacific Coast Highway, Hermosa Beach, CA 90254. They own the Forth trademark and are responsible for distributing FIG-Forth, the public-domain version available for almost all computers. ■

Terry Kepner is a writer and programmer, and an Associate Editor of 80 Micro. He's been writing about microcomputers since 1979.



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Hard Facts About Tandy's New Software

Tandyland

Radio Shack's fall line-up of new software had something for everyone, with offerings for the Models III, 4, and 2000. Tandy 2000 owners will notice a new terminal package called Softerm-2000 on the shelves as well as two programs from the popular PFS series, PFS: Graph and PFS:Write. The introduction of new business software for the 2000 shows Tandy's continued commitment to its first MS-DOS machine despite the debut of its IBM-compatibles.

For the Model 4 owner, fall brought new business programs, including Financial Management, Profile 4, Radio Shack's Money Decision series, and an educational package called Introductory Science.

Model III gamers weren't forgotten, either; Computer Diplomacy, Frogger, and Zaxxon are now available for the Model III. Radio Shack also sells a Model 4/4P version of Zaxxon.

Meanwhile, Tandy's entry into the IBM-compatible world means some big changes in Radio Shack's software market. Unlike the good old days, when Radio Shack was the primary software source for its proprietary TRSDOS operating system, the Shack now has plenty of competition for Model 1000/1200 software sales.

When *80 Micro* asked if the introduction of the new machines might put Tandy out of the software business, Tandy 1000 buyer David Frager responded, "Tandy will continue to produce software for all its machines as the need for software arises. If we

edited by Bradford N. Dixon



Photo 1. The Tandy 1200.

see a need that isn't being filled by a third party MS-DOS software company, we will definitely examine if we should provide the product."

Frager also noted that Radio Shack's Express Order software program won't offer much MS-DOS software for the Tandy 1000 because users can get MS-DOS titles at other computer stores. Nonetheless, Radio Shack Computer Centers will carry selected third-party titles that they deem to be high-quality products.

Among third-party MS-DOS products Radio Shack is stocking are Ashton-Tate's Framework and dBase III, all of the PFS titles from Software Publishing, and MicroPro International's WordStar Professional.

Model I/III/4 owners who move over to Tandy's new hardware offerings, the Models 1000 and 1200, may be in for a case of sticker shock when they start checking out the price of MS-DOS software. For example, Lotus' son of 1-2-3, the integrated package Symphony, sports a price tag of \$695.

Print and television advertising campaigns have made Symphony a visible product. But sales and conversions from 1-2-3 haven't lived up to expectations, and price may be partly to blame. Turning to Symphony's chief competitor, Ashton-Tate's Framework, won't save you money—it retails for the same price.

For those who don't mind spending as much on a program as a lot of people spend on a computer, Symphony and Framework should run as-is on the Models 1000 and 1200.

Almost as soon as Tandy introduced the Model 1200

(Photo 1), its "mirror-image" IBM PC XT work-alike, rumors about where the computers were being manufactured started to fly. According to the most prevalent rumor, Tandon Computer Inc. was the manufacturer.

When *80 Micro* asked Ed Juge, Tandy's director of computer marketing, about the story, he said that company policy dictates that the company's sources remain confidential. Juge noted that he, too, had heard the rumor, but would neither confirm nor deny it.

Radio Shack Computer Centers are polishing their image with a slick new flyer aimed at potential computer buyers for business, education, and home use. It's a vast improvement over the old flyers that were stuffed into Sunday newspapers.

Called "Radio Shack Computer Center Answers," the brochure (Photo 2) poses questions from a hypothetical computer buyer; the answers, of course, highlight a Tandy machine that exactly meets the ques-

tioner's needs. The flyer looks like a newsletter printed on glossy stock.

This new ad campaign may well bring attention to the quality image Tandy wants to communicate to buyers. It's yet another example of the Shack's long-overdue effort to solve its image problem.



Photo 2. Tandy's new brochure, "Radio Shack Computer Center Answers."

Bulletin: "There is a new version of TRSDOS 6 which contains several improvements and also includes some new features not previously available in this operating system. Upgrading to this new operating system is required."

These words are taken from a Tandy customer service bulletin dated March 15, 1984; similar notifications are mailed out for upgrades of other operating systems or software. The final paragraph of these customer service bulletins instructs the software owner to pick up an upgrade at the local Radio Shack Computer Center. All well and good, but what's a customer to do when he gets to the computer center and there's no upgrade waiting for him? It's bad enough when the new software isn't in the local store; sometimes a customer may be told it's out of stock at the Fort Worth warehouse as well.

Fear not, there is a way to get the first available upgrade even though the warehouse is empty. Tell the manager of your computer center to order the upgrade with your name and address on it. Then, the next time the warehouse receives a shipment of the upgrade, your order will be flagged and sent.

It seems that computer center managers can order upgrades in two

ways: for their own inventory or by customer name and address. Inventory ordering has a lower priority than special orders and when shipments come into the warehouse, they aren't earmarked for the stores needing upgrades. If the stock is there, it's sent out, but if it isn't, then the store manager has to try again later. Only personal orders are flagged.

The logic behind the arrival of cellular remote telephones in some Radio Shack Computer Centers became a little clearer last fall with the announcement that Radio Shack had worked out a customer referral arrangement with mobile telephone companies in five major markets. The companies involved are NYNEX Mobile Communications, PacTel Mobile Access, NewVector Communications, Contel Cellular, Gencom, and Bell Atlantic Mobile Systems Inc.

Tandy's press release didn't say exactly how much Computer Center space would be devoted to telephones, but considering the number of computers available from the Shack, things may get a little crowded in those stores that support the new marketing venture.

New Threads

"Phone booth journalism" was the phrase reporters used to describe how Radio Shack's Model 100 changed their reporting habits at last year's Republican National Convention.

According to Tandy, the lap-top portable revolutionized political reporting in the 1984 election. Press planes were full of reporters using Model 100s to write stories; when the planes landed, reporters raced for phone booths to transmit their stories to host computers back at the newsroom.

Reporters from the *Wall Street Journal*, the *New York Times*, the *Washington Post*, and the Associated Press were among those using Tandy lap-tops at the convention. Tim Gallivan, AP's news technology editor, notes that AP owns about 200 Model 100s. Gallivan says that, to his knowledge, AP was the first news organization to adopt the notebook-style computer for remote reporting;

the wire service had the computers even before Tandy distributed them nationally.

With one foot in the grave, Lobo Systems of Santa Barbara, CA, introduced a \$795 Model 4P clone that runs LDOS and CP/M software. The Mini Max, as it's called, is designed to go head to head with Radio Shack's transportable. Lobo already has a Model III work-alike in its Max-80, which retails for \$945.

Lobo's president, Robert Bledsoe, quoted in the Oct. 15, 1984 *InfoWorld*, said he didn't see any problem in staying with a CP/M machine or in competing against Radio Shack. Bledsoe hopes sales will offset some of Lobo's \$1 million in liabilities. "There's enough demand for CP/M-based machines," he said. "If we can sell 100 to 200 machines a month, that will meet our needs. We aren't looking for high volume."

Lobo may be the last of only a handful of one-time Radio Shack clone manufacturers. According to the *InfoWorld* piece, LNW Computers of Tustin, CA, the only other surviving clone maker, was reportedly out of business as of late September 1984.

Another ruling from the courts in the complex area of software copyrights: Federal Judge W. Arthur Garrity of Massachusetts ruled on Aug. 31, 1984, that copyrighted programs published in a computer-user magazine may not be put on disk, duplicated, and sold by a third party.

Nibble Magazine, for Apple users, had sued Amtype Corp. for copyright infringement for selling the magazine's programs on disk. *Nibble's* publisher, Micro-Sparc Inc., already provides such a service by selling program disks for \$20-\$30.

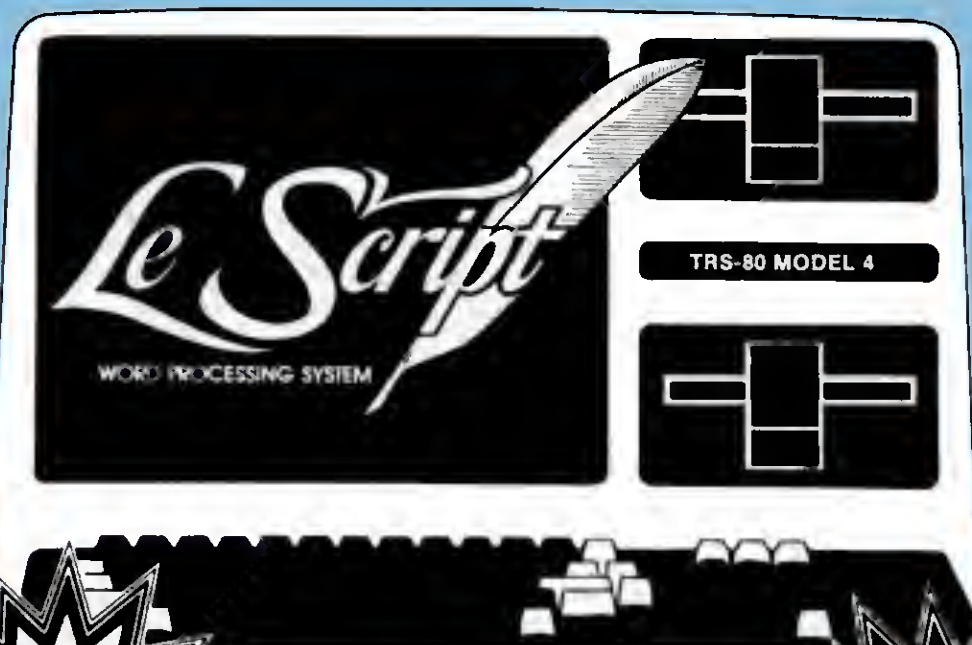
In its defense, Amtype said it offered a "typing service" to readers of *Nibble* and other similar publications. Amtype charged between \$7-\$10 for putting all the programs from a single *Nibble* issue on a floppy disk.

Judge Garrity was to rule on possible damages at a later date.

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tino, CA, released some statistics last fall that put them in third place in the personal computer market. The former third-place company was Tandy Corp.

Hewlett-Packard made a point of the fact that it couldn't confirm or deny the validity of the statistics that put the firm right behind IBM and Apple. However, HP credits its apparent rise to third place to the success of the HP 150 Touchscreen Personal Computer.

As for market share, IBM holds first place in the \$1,000-\$6,000 desktop/portable market with 33 percent of sales, Apple comes in second with 20.7 percent, and HP is a distant third with 6.1 percent. Tandy Corp. now holds fourth place, according to the information supplied by HP, with 5.2 percent of the desktop/portable market (see Table 1).

Manufacturer	Percent Market Share
IBM	33.0
Apple	20.7
Hewlett-Packard	6.1
Tandy	5.2
DEC	3.0
NEC	3.0
Others	29.1

Table 1. Hewlett-Packard's ranking of the top firms in the \$1,000-\$6,000 desktop/portable market.

What's ahead for the business office?

Frost and Sullivan, a New York market research firm, recently released a study predicting that personal computers will shape the course of office automation over the next five years. That isn't hard to believe, but the dollars involved may come as a surprise.

The report indicates that word processing applications sales will increase by 23 percent to \$10.7 billion by 1988. Unit sales for word processing equipment are expected to increase by 30 percent yearly. That's because of the inroads personal computers have made into the managerial and professional ranks: According to the wordy report, "The multifunctional capability of both word and data processing of the desktop computer makes it well suited to the needs and tasks performed by those in these job levels."

Frost and Sullivan considered as word processors dedicated units and

even electric typewriters, but predicted that personal computers will become the major component of the word processing market for the next five years.

Speaking of growing computer use, some new figures show a startling leap in the number of computers available to public school students. According to Quality Education Data, a Denver research marketing firm, the number of students per microcomputer has dropped by half since 1983. During the 1983-84 school year, the national average was 170 students per micro; by the beginning of the 1984-85 school year, that average had improved to fewer than 85 students per computer. The top school district is Florida's Broward County, where the ratio is 23.4 students per computer.

QED's report, called "Top Fifty Districts," also showed some gains by IBM in the battle for the educational dollar. Big Blue's share jumped from 4.6 percent of all micros in schools in 1983-84 to 6.05 percent for the current school year.

Apple computers, however, still dominate the education market, with a 47.9 percent share among large school districts. Radio Shack holds second place with 22.4 percent and Commodore is in third, according to the report, with 10.4 percent. IBM remained in fourth place despite its increased infiltration (see Table 2).

Hot Items

Software Arts of Wellesley, MA, the company that developed the classic spreadsheet program VisiCalc, has been working for some time to come up with another blockbuster program. Now it may have one: a PC desktop management program called

Spotlight. Belonging to the new genre of microcomputer accessory software, Spotlight acts as a calculator, note pad, appointment calendar, telephone book, and index file deck. In fact, the program sounds very much like the Tandy DeskMate program that comes bundled with the Tandy 1000.

Desktop management programs have gained attention since Apple introduced one with their Macintosh a year ago, and the price for such programs remains fairly reasonable. Spotlight retails for \$150, a moderate price for professional software, but not exactly chopped liver. If the program is comparable to the Tandy DeskMate, then the rock-bottom price of the Tandy 1000 is even more of a bargain.

Yes, but can you back it up? Elite Software Systems of Albany, NY, is staking some serious money on its claim that its new encryption program, Encomp, defies piracy. The company is so confident of its MS-DOS-based product, it's offering a \$10,000 reward to any individual who can break the code. Elite will award an additional \$2,000 to the dealer who sold the program.

IBM's relentless quest for more memory in less space took another step forward recently as the computer giant began producing volume quantities of a 256K chip.

The 50.5-square-millimeter chip occupies only twice as much area as a 64K chip and makes it possible to assemble more than 4 million characters on a 7- by 9-inch circuit card. The significance of all this becomes clear when you consider that in terms of real storage, you could put the contents of a 1,400-page book on a single chip. ■

Manufacturer	Number of Units		1984 Market Percentage
	Fall 1984	Fall 1983	
Apple	35,256	15,879	47.9
Radio Shack	16,495	10,098	22.4
Commodore	7,700	3,494	10.4
IBM	4,449	1,676	6.0
Atari	3,200	3,106	4.3
Texas Instruments	3,180	952	4.3
Franklin	2,151	1,102	2.9
Others	1,139	525	1.5

Table 2. 1984 computer market shares in the top 50 U.S. school districts.

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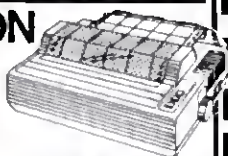
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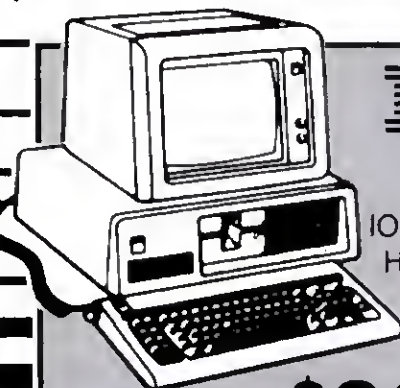
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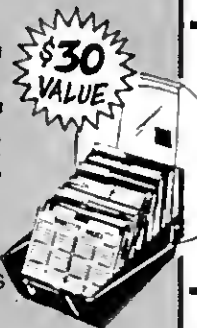
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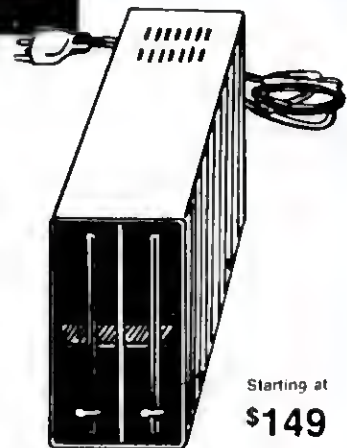
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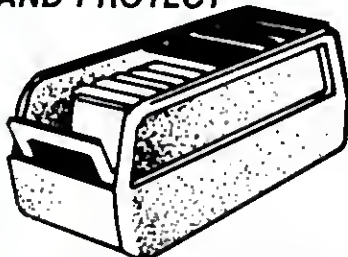
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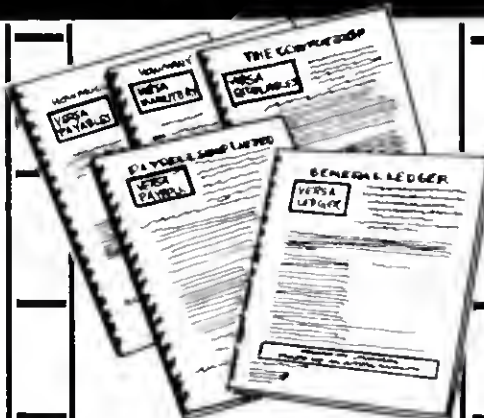
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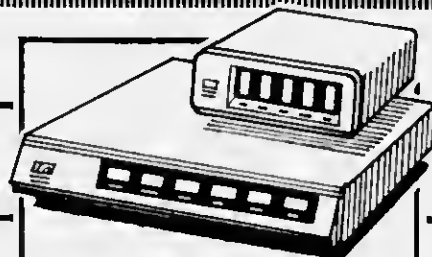
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Lazy Writing

After many unsuccessful attempts at trying to get my Model 4 to use the spooler with Lazy Writer, I wrote to AlphaBit Communications, Inc. The solution, though not included in the manual, is simple. Copy the SYS-DRV/CMD file, found on the Lazy Writer disk, for 6.X.X to P1/CMD. When the spooler is operational, it's automatically used with Lazy Writer. I use this JCL file to activate the spooler:

```
1 SET *LM CLICK/FLT
2 FILTER *KI *LM
3 SPOOL *PR TO TEXTFILE:1 (MEM=5,
DISK=5)
4 L X X1
5 //STOP
```

*Lance K. Mertz
Snohomish Publishing Co.
114 Ave. C
Snohomish, WA 98290*

Better Positioning

I merge this one-line utility with my programs to get each PRINT@ correct on first trial:

```
65000 X = PEEK(16416) + 256*(3ANDPEEK
(16417)):PRINT@1016,X;" "@X,CHR$(14);:
Z = PEEK(14400):Z = 2*Z:Z = Z/2:
PRINTCHR$(15);:PRINT CHR$( - 27*(Z = 8)
- 26*(Z = 16) - 24*(Z = 32) - 25*(Z = 64));:Y$ =
INKEY$:IF Y$ = " " AND Y$ < "I"
AND X < 1023 THEN PRINT Y$;:GOTO
65000 ELSE 65000
```

You'll get a nondestructive cursor that you move with the arrow keys, while your program displays the position in the lower right corner. You can even use this as a screen editor since it accepts alphanumeric input.

*Thomas Eggarter
Chatadata Inc.
Ramirez Mitchell 358
5700 San Luis, Argentina*

International Style

Daisy-wheel printer owners who type in foreign languages will be pleased to know that Radio Shack released a



daisy wheel, Scandia, that includes both Spanish and Danish characters. You access them via the SuperScript System Code utility.

*Carlos Ortiz
119-37 Metropolitan Ave. #30
Kew Gardens, NY 11415*

CLOADing

I'm able to run "Catacomb Conquest" (August 1984, p. 78) on my cassette-based Model III using "NODOS 80" (1983 Anniversary Issue, p. 96). Hopefully, "NODOS 80" will let me run other disk-based programs from 80 Micro.

*Norman Jennings
1605 Walton Street
Cornwall, Ontario
Canada K6H 1W3*

Due to hardware interface problems, the bar code reader program originally scheduled for this issue has been delayed; we will publish the program as soon as we resolve these problems.

Also, because of Tandy's involvement with the Radio Shack showcases, Ask Tandy will not appear this month; the column will resume in February.

—Eds.

For Geminis Only

Glenn Parkinson's FORMGEM ("Character Sketching," March 1984, p. 156) works perfectly on the Gemini-10X printer with only two changes. First, change the CHR\$(136) in line 1390 to CHR\$(8), and then change the CHR\$(132) in line 1430 to CHR\$(4).

*Mark Allen Reed
Box 368
West Lebanon, NH 03784*

I recently purchased Model 4 SuperScript only to find that none of the printer drivers furnished with the program works with my Gemini-10X.

The drivers send a CHR\$(15) to the printer, resulting in condensed-mode printing. You can prevent this code from reaching the printer with forms filter. Type in these instructions at TRSDOS Ready:

```
SET *FF FORMS/FLT
FILTER *PR *FF
FORMS (XLATE = X'0F00')
SYSGEN (YES)
```

The first two lines set the forms filter, while the next line converts all CHR\$(15)s to CHR\$(0)s. The last line writes the configuration to disk, and the printer driver now works properly.

*Jerome D. Khutts
Route 2, Speedway St.
Campbell, MO 63933*

Reader Aid

After unsuccessfully trying to run Model III graphics programs on the Model 4P, I realized that the Model 4P doesn't contain a Model III ROM. Because of this difference, the Model 4P prints incorrect graphics. Any suggestions?

*Jim Gonsalves Sr.
2257 Manhattan Place
Santa Clara, CA 95051*

We had the same difficulty and found that POKE 16892,02 corrects this problem on the Model 4P.

—Eds.

READER EXCHANGE

Can anyone suggest a professional astrological program to run on a 48K Model III with twin double-density drives? The program should be able to print natal and harmonic charts.

Roger G. Dawson
22 Lancaster Road
Preston, Lancashire
England, PR1 1DA

I'm looking for the automatic sequential dialer program that was first seen in the movie *War Games*. I've been told that its name is AMODEM-90 and that it's a public-domain program.

Richard H. Epson
1440 Sumner Ave.
North Charleston, SC 29406

I give up—how do I get to the last level in *Deathmaze 5000*? Also, I'm trying to locate a copy of a game program called *Space Age 21*.

George D. Madison
P.O. Box 649
Winchester, OR 97495

Error Trap

In line 8 of "Double Trouble" (Reader Exchange, October 1984, p. 29) BACKUP SYS:0 should read BACKUP SYS0:0.

Gil Seiler
126 Boas Drive
Santa Rosa, CA 95405

Incorporate this change in Alain Cirkovic's *Easydata* program ("Little Wonder," December 1984, p. 72) to get a directory in TRSDOS: Change Dir to D: in line 380.

—Eds.

DEBUG

Listed below are modifications to X-Mart ("Attention Shoppers," August 1984, p. 75) to eliminate the syntax error that occurs in line 290 when you try to exit the program. Delete line 1210 and make the following changes:

```
290 D1=LEFT$(C3,X-2);D2=MID$(C3,X,
LEN(C3)-1);IFC3="QUIT" 1210 ELSEIF
QH<>0THEN340
```

```
1210 PRINT@576,"SURE? ";:GOSUB
1300:IFN=0THENPRINTA:GOTO 280
ELSEF=1
```

Also, to eliminate two additional

bugs, change lines 710 and 740 to read:

```
710 IFC2="CAN"THENIFJ=58THEN
IFE(38)=2THENPRINTDZ:FORT=1
TO800: NEXT:E(38)=0:GOTO80ELSE=
BELSEA=DELSEIFC2="POC"THEN
IFE(21)=1 THENIFE(40)=2THENE(40)=
0:I(40)=J:PRINTDF:FORT=1TO800:
NEXT:GOTO80ELSEA=BELSEA=D8
```

```
740 IFC2="WAL"THENIFE(5)=2THENE
(5)=1:E(46)=1:I(5)=J:I(46)=J:A="YOU
NOW HAVE AN"+B(5)+"AND A"+
B(46):Q=Q+2ELSEA=B
```

Finally, several readers have had problems after they have been ar-

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The Alternate Source Programmer's Journal has published a "Special Issue", full of great information for any serious users and programmers.

Want to know what's popular in the TRS 80 software world? We've compiled this list of the "top ten" in order based on our sales for one month ending in November.

1. LESCRIPT (\$99.50)
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Here it is, this month's installment in our "Games Top Ten", in order, based on sales for one month ending in November:

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rested for jaywalking. After falling asleep they can move around, but can't manipulate objects. This isn't a bug! After moving around approximately 20 times, the player once again wakes up in jail. Because you're not actually playing during the dream, you can't manipulate items. Pay attention to the message that appears during the dream—it helps you escape from jail.

*Joshua Barinstein
124647 Victory Blvd.
N. Hollywood, CA 91606*

"The Direct Approach" (September 1984, p. 96) does work on the Model 4P, contrary to what's stated in the Key Box. Also, the following changes prevent garbage collection: Line 10010 should contain an OUT 132,142 immediately following the POKE, while line 10200 should contain an OUT 132,135 immediately following its POKE.

*Seth Monger
4694 Coos Bay Wagon Road
Roseburg, OR 97470*

Please note the following corrections for "Bugs from Outer Space" (March-August 1984). Line 100 of Text6B should read:

00100;****PART6B

Change line 350 of TEXT6D to read:

00350 ERROR1 JP 7637H ;8637H for Mod3 TRSDOS

The buffer for adding scores to the scoreboard isn't properly closed. The Program Listing corrects this problem.

To assemble Text6E, load the completed game using System or Load, and then load Text6E. Save the complete game as described in the August 1984 issue (p. 88).

*Roger Smith
505 Ridge Lake Road
Crestview, FL 32536*

Send correspondence to Reader Exchange, c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

Program Listing. Correction to "Bugs from Outer Space."

```

00100 ;****PART6E
00110 ;CORRECTS BUGS IN SCOREBOARD
749A 00120 ORG 749AH ;849AH FOR MOD. III TRSDOS
749A CD1578 00130 CALL OOPS ;PATCH
7815 00140 ORG 7815H ;8815H FOR MOD. III TRSDOS
7815 D5 00150 OOPS PUSH DE ;SAVE DE
7816 3E20 00160 LD A,32 ;A=SPACE
7818 0606 00170 LD 0,6 ;6 CHARACTERS
781A 12 00180 OOP10 LD (DE),A ;STORE SPACE
781B 13 00190 INC DE
781C 10FC 00200 DJNZ OOP10 ;LOOP
781E D1 00210 POP DE ;RESTORE
781F CD0362 00220 CALL 6203H ;7203H FOR MOD. III TRSDOS
7822 C9 00230 RET
0000 00240 END
00000 Total Errors
OOP10 781A
OOPS 7815
    
```

End

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T/Maker: Functional CP/M Integration

by Eric Grevstad

edited by Ryan Davis-Wright

The age of integrated software didn't begin with the IBM PC and Lotus 1-2-3. Since 1980, programmer Peter Roizen has been merging CP/M-80 applications into T/Maker, fitting the software concept of today with the hardware and operating system of yesterday. T/Maker includes word processing, spreadsheet, and data base management capabilities in one package.

The latest T/Maker (version 4.01) is no threat to new PC packages like Lotus' Symphony or Ashton-Tate's Framework, but the CP/M world has nothing else like it. If you have the patience to learn its syntax, T/Maker delivers genuinely flexible integration. It's an impressive piece of programming, as long as you don't compare it to dedicated word processors or spreadsheets.

A Clean Slate

To give T/Maker a high compliment, it's as close to a blank sheet of paper as a Model 4 program can get. When you boot up the system, it presents you with a blank screen.

T/Maker has a switchable menu to execute its English-language commands and supplies on-line help for its sometimes cryptic keyboard functions. While the program may seem difficult to use at first, T/Maker tries to make things easy for you.

Don't be afraid when you open the box and five disks fall out. You'll need the first disk each time you start the program (and whenever you want help), but you'll do most of the work

with the second (editing, spreadsheet, data base, and printing) and third (list processing, graphics, and spelling checker with 15,000-word dictionary) disks. The fourth disk contains a 35,000-word auxiliary dictionary, and the fifth is a demonstration/tutorial.

Since T/Maker usually reserves drive B for data, you'll be swapping program disks in and out of drive A. Invoke a disk-3 command with disk 2 in the computer, and a "Command Failed: Nonexistent" message prompts you to try again.

You can change the data drive or other defaults with a program called TModify, which also lets you reconfigure the T/Maker keyboard rather than use its standard pattern, awkward for things like cursor movement.

Some of this has already been done for the Model 4/4P version. The arrow keys function and an addendum to the manual tells you how to emulate other CP/M terminals (the TRS-80's break key works the same as others' escape keys, and control-L replaces the

missing tab key). While T/Maker comes configured for 128K RAM and CP/M Plus, it also includes set-up instructions for Montezuma Micro's 64K CP/M 2.2.

Commands And Conversations

While other programs prompt you with question marks, T/Maker's interface is a chatty "What Next?" You answer it with English commands: "Create" starts a new file and prompts you for a file name, and "Edit" brings you into the file. You can save time by entering commands together (Create

Newfile Edit, or Align Save Print It), though the instructions grow less grammatical as they grow more detailed; Print Nonstop From 10 To 30 It, for example, prints pages 10-30 of the current file without format queries.

Many of T/Maker's vital commands only work downward. A command to align or print text, for example, affects only the portion of the current (RAM-based) file below the top line shown on-screen. In most cases, you'll either move to the top of the file beforehand or use T/Maker's framing command, which is similar to a spreadsheet's ability to freeze a column of labels while viewing other data.

T/Maker's most important command, though, doesn't directly affect anything. Edit (E) removes the "What Next?" prompt and activates T/Maker's editor, the heart of the T/Maker system. It's a free-form program that lets you put anything you want anywhere on the screen, but it's a slight exaggeration to call it a word processor.



Illustration by Katherine Mahoney

You create every T/Maker file, whether it's a document, spreadsheet, or data base, through its editor.

As mentioned, the editing screen is initially blank. Pressing break and then the ? key calls up a status line that indicates the current file's name, length, free space, current cursor position, and carriage-return mode. (To explain the last, break-R rotates among manual returns, word wrap after 63 characters, and spreadsheet-style horizontal scrolling, while break-

search and search-and-replace functions (break-' and break-' respectively) are fast and accurate.

Words Under Wedges

Oddest of all is T/Maker's approach to margin setting and justification. Instead of embedding commands or keystroke sequences, you set line width by typing in pairs of wedges (<< >>) delimiting text boundaries. The wedges shape the text below until T/Maker encounters the next set of wedges. Minor changes, such as a right wedge of ->> versus >>, yield justified, ragged, or centered copy for block-style or indented paragraphs.

T/Maker doesn't format text until you leave the editor and use the Align command, which reads the wedges and adjusts the text accordingly. It also runs paragraphs together unless there's a blank line or a single period between them, turns columnar tables into prose if you forget the "do not align" wedges (>> <<), and puts two spaces after question marks, exclamation points, and periods (including the one in Mr. Jones).

While T/Maker's word processing features make you long for Scripsit, its spelling checker is quite good, in an odd sort of T/Maker way. Entering the Proof command (with the first line of your file at the top of the screen) produces a handy table tallying the file's total number of words, unique and unfamiliar words, and the average number of characters per word and words per sentence.

When you return to the editor, you'll not only find the unrecognized words tagged in your file but a double list, with two copies of each offending word per line, appended to it. Fix the second sample of each word and it'll be changed throughout your file when you issue the Correct command, or added to the dictionary with Amend. You can even ask for help, changing the second sample to something ambiguous like "rhy?hm" and asking T/Maker to spell it.

Monster Math

I also like T/Maker's skill with lists and tables. Once you learn the lingo, it sorts and shuffles columns of data easily and quickly. If the first item is at the top of the screen, the command Sort A N 12 32 puts the numbers in columns 12-32 in ascending order.

You could also sort a list of characters, or sort in descending order.

A similar command, Tally, is more explicitly mathematical. It takes lists (files with plus signs in the first column of each line), breaks them into categories by column number and, if you want, sums the numeric values associated with them. For example, I could tally the second and third columns of a list of dinner guests, their sex and their ages, and learn there were three males and four females, with combined ages of 82 and 103, respectively.

The further you get into mathematical work, though, the more T/Maker's word-based structure hinders you. It works best with vertical lists. With plus and minus signs running down the left margin and an equals sign at the bottom, the Compute command can solve the list as if it were an algebra problem.

Beyond this, you're into T/Maker's spreadsheet. Like its other program features, the spreadsheet is great at merging data into business letters but terribly difficult to master. If you can imagine a word processor with no Delete Word function, imagine a spreadsheet with no cells, parentheses, or automatic recalculation for "what-if" changes.

T/Maker's way of defining column widths (up to 50 computable columns) isn't necessarily bad. The top line of a spreadsheet is an example line (labelled "ex") and contains maximum width numbers such as 99,999.99. Any numbers below them, even if not perfectly lined up, will be realigned to match the examples (with or without commas, and with the same number of decimal places).

The rest is like VisiCalc in reverse Polish notation. All mathematical functions (from + and / to exp and abs) appear not in row and column intersections, but externally, running down the left side or across rows atop or between spreadsheet entries. This system works for simple sums, but calculating a specific cell without anything like a cell formula is murderous.

In addition, T/Maker doesn't use parentheses. Its inflexible method of operation is to do all additions, subtractions, multiplications, and divisions in that order. To overcome this, you must sprinkle the spreadsheet with instructions: ac1 (first step, compute for all subsequent rows), jc2 (second,

T/Maker Integrated Software



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Mountain View, CA 94043
415-962-0195
Models II, 4/4P (requires CP/M),
Tandy 2000
128K RAM
Two disk drives
\$450

Easy to use? ★ ★ ☆ ☆ ☆
Good docs? ★ ★ ★ ★ ★
Bug free? ★ ★ ★ ★ ☆
Does the job? ★ ★ ★ ☆ ☆

I toggles an insert mode. A ruler below the status line helps you set margins and tabs.)

Running under Model 4 CP/M, the editor suffers from poor typing response and keybounce (if I were using it to write this, it'd be a review of Tt/Mmaker) and it lacks some useful functions, such as cursor movement that wraps around lines or a way to delete words as well as characters. There are no true block-move operations, but you can copy lines one at a time into a 40-line buffer for movement (first in, first out) elsewhere.

On the positive side, the editor's embedded print commands are convenient: ".single" and ".double" control line spacing, and ".newpages" starts a new page if fewer than five lines are left on the current one. Footnotes are handled automatically, and

just compute for the next row), rc3 (third, rarely compute only on subsequent rows derived from other rows).

After studying the manual's examples and typing them in, I'll admit that T/Maker's spreadsheet can do some sophisticated things, such as built-in notations for functions like growth rate and rounding interim values. But doing them requires learning a whole new approach (even stranger than dBase II language) that applies to no other spreadsheet on the market. The system almost requires enough pre-planning with pencil and paper to defeat the whole purpose of spreadsheet work.

Keeping Records

Clearly, the spreadsheet is T/Maker's worst feature. I'm a lot happier with its data base manager which, while requiring similar pains in setting up, performs swiftly and capably once the job is done.

The data base, as you'd expect, is a text file created with the editor. It begins with sections (<form>...<end> and <record>...<end>) describing how a record will appear on the screen and how T/Maker will file it. A record can have up to 120 fields of 80 characters apiece, with field lengths defined by curly braces (left-shift/@ and right-shift/@ on the Model 4 keyboard).

Once you define a data base, the Update command works much like the regular editor, letting you review or alter records one at a time (the search function for individual items is unchanged, the "next word" cursor movement command becomes "next record"). As with lists, you can rearrange a data base alphabetically or numerically, in ascending or descending order.

For more precise work, the Select command finds groups of records easily. Altering all the records in a data base is as easy as reentering the file, changing the form and record definitions, and adding another definition for use with the Set command (such as Status = Prime When Income > \$50,000).

T/Maker is no R:Base or Profile, but its data base is a nice variation on the text-oriented theme. When using Update, for example, the break-? status line changes from an editing ruler to an indication of how many more

records of the current length can fit in a file.

Mixed Impressions

There are other good things about T/Maker. While it doesn't have windows, the List command lets you look at a second file without losing the current one in RAM. It's a breeze to chain, merge, and insert different files of different types for printing (one print command strips away ugly example and instruction lines from the spreadsheet).

The command menu is handy for beginners, though users will soon skip it in favor of stringing together multiword commands. The help screens are excellent: well-organized, well-written, and valuable even to seasoned users who haven't used a particular function in a while.

And the documentation is first-rate. There is a superbly organized 400-page manual and two reference booklets, as helpful and readable as anything I've seen in some time. It's relevant to remember that T/Maker has been around since 1980, gathering a group of hardcore fans. It's not only thoroughly debugged, but thoroughly documented.

I also used T/Maker on the Tandy 2000, and liked it better on that machine than on the Model 4. It was considerably faster, not so much in terms of commands like Align (for which T/Maker goes to disk) but in terms of general feel and responsiveness. The 2000 T/Maker has a full invaluable implementation of function keys: PgDn sure beats break/control-P for "move to end of line."

Is T/Maker worth \$450? It's certainly worth the increase from the prior version, T/Maker III (still available at \$275, but with no spelling checker, no data base, and no on-line help). It does look good when you compare its cost to several separate programs, which aren't able to merge or create such versatile files. And none can compare to its blank-paper approach only now being seen in MS-DOS products like Aura and Enable. On the other hand, the standalone programs beat T/Maker's performance in some vital areas.

T/Maker is an extremely versatile, somewhat awkward text editor with fast and intelligent search functions and limited mathematical capabilities.

If Framework is the sleek new Porsche of integrated software, T/Maker is an old Plymouth Road Runner with a big V-8 and a bad clutch. While it may be inefficient and hard to maneuver around town, it has great power and performance on the straightaway.

I wouldn't choose T/Maker's editor over a real word processor and I wouldn't choose its spreadsheet at gunpoint, but it's the closest thing to real integration that CP/M will ever see. It is certainly worth considering. If you only want to learn one set of commands, it's worth using. ■

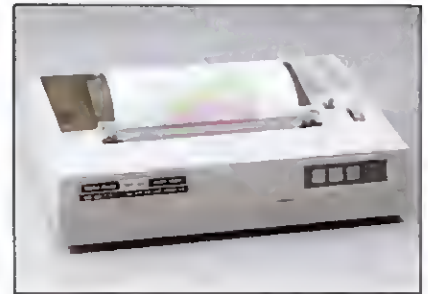


Photo. The CGP-220 printer.

Color Me Beautiful: Radio Shack's CGP-220 Color Printer

by **Bradford N. Dixon**
80 Micro Technical Editor

Radio Shack's CGP-220 ink jet printer is compact, quiet, and colorful. But the CGP'S most remarkable feature is its low price: For \$699, home computerists and small-business users can get high-quality color printouts of screen graphics.

The CGP-220 is compact (15 3/4 by 11 5/8 by 4 1/4 inches) and lightweight, weighing only a little over 12 lbs. It has a spare and uncluttered design, with the operating switches on the unit's right front side. The Ready, Alert, and Power indicators are also located there. The Reset, Paper Feed and On/Off line switches are touch sensitive, lying flat on the front.

The slots for the ink jet's color and black ink packets are hidden from view by a door on the front. The ink packets come inside plastic cartridges so you never handle the ink. On the left, underneath the paper cover, is the ink pump. Before you can do any printing, you have to prime the ink jets with a few short pushes on the green pump lever.

MODEM — 80

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Figure 1. The CGP-220 took about three minutes to make this screen dump graphic.

The power cord connector is on the back, with parallel and serial interface connectors, as well as a 600-/2,400-baud switch.

Features and Performance

After you're acquainted with the machine and have inserted one of the three sheets of paper included with it, you can start printing. While the print



Figure 2. All the designs were printed clearly, with no color bleeding.

speed is an unimpressive 37 characters per second (for the full ASCII and special-character sets) this is of little importance, since you'll probably use the machine almost exclusively for graphics. In the graphics mode, the CGP-220 moves along at 2,630 dots per second and features bidirectional scanning. The printout in Fig. 1. took about three minutes to produce.

The ink jet prints in seven colors (black, red, green, blue, yellow, magenta, and violet) by mixing the yellow, magenta, and cyan base colors from the color packet cartridge. Even the most demanding designs are clear and sharp, and none exhibit color bleeding (see Fig. 2).

The quality of the paper used to produce the screen printouts makes a lot of difference in its final appearance. The CGP-220 will print on cut sheets or on roll paper, but not on form-feed paper. Radio Shack sells roll paper (catalog number 26-1333, three rolls for \$9.95) and single sheets (catalog number 26-1341, 250 sheets for \$6.95) for the ink jet printer. While I tried other types of stock, including high-quality bond paper, photocopy machine paper, form-feed paper (without the pin holes), and special paper from a Diablo ink jet printer, the Radio Shack paper produced the best results.

Using the CGP-220

The easiest way to use the ink jet printer is in the text mode, the default mode at power-up. You select the color of print desired and whether you want normal or elongated characters as the print style. You can issue print commands in all print modes from Basic without the cumbersome use of DIP switches inside the printer.

While print quality in the text mode isn't as good as Radio Shack's other dot-matrix printers, it is readable.

The CGP-220 was made to create graphics and in that capacity it performs superbly. When you use it with Tandy's Model 2000, which has one of the best screens available for color graphics, you lose virtually none of the resolution in transferring a picture from the screen to paper. Although there are differences in color because of code incompatibilities in the computer and the printer, you can avoid these with careful programming.

The MS-DOS disk that comes with

the Model 2000 contains a screen dump program for the color printer (CGPDMP.BIN) which you call from Basic when you want a screen dump. On Radio Shack's Color Computer, another screen dump program is available that transfers intricate designs from the CoCo's screen onto paper.

CGP-220 users don't have to use a Model 2000 or a CoCo to get a lot out of the printer. Programmers using the Models I, III, or 4 can also take advantage of color graphics by programming the printer directly from Basic in the CGP-220's bit-image mode or the color-scan mode.

The bit-image mode lets you address each of the 640 horizontal dots per line and seven vertical dots to produce colorful designs and business

CGP-220 Color Printer



Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102
\$600

Easy to use?	★★★★☆
Good docs?	★★★★☆
Bug free?	★★★★☆
Does the job?	★★★★☆

graphics without a color computer. Of course, the biggest drawback to using one of Radio Shack's non-color computers is that you can't see what you're creating until it's printed. Another disadvantage of using a Model III or 4 with the CGP-220 is that you can't use the screen dump command to produce hardcopy because the character set in the printer does not recognize TRS-80 block graphics. If you press the shift/down-arrow/asterisk key combination on a Model III, any block graphics on the screen will appear as periods on the CGP-220.

The color-scan mode on the ink jet printer is similar to the bit-image mode, but allows for greater manipu-

lation of color. This mode uses large amounts of memory, however, and programming in it is difficult from Basic.

The Documentation

The printer's manual makes using the machine effortless. It's well-written and easy to understand, with examples to illustrate the CGPs capabilities.

The manual's lengthy table of contents directs you to areas that describe advanced features without searching through the 52-page book. Separate chapters in the manual describe the process of color printing, setting up the printer, descriptions of the various control codes, and lessons on the three kinds of printing available with the CGP-220.

Radio Shack also provides extensive appendices with additional programming tips, care and maintenance sug-

*While the text quality
isn't outstanding,
it's adequate as
dot-matrix printers go.*

gestions, troubleshooting aids, and schematic diagrams of the machine. Any user can get the most out of the manual whether a novice or a seasoned programmer.

Conclusions

With a machine like this, you'll want to try out different color combinations and graphics. The CGP-220's ink cartridges let you print up to 4 million characters before you have to replace them. Replacement ink cartridges cost \$9.95 for the black ink pack and \$14.95 for the tri-color. I've used the CGP-220 for many complex screen shots for three months and still have plenty of ink left.

While the text quality isn't outstanding, it's adequate as dot-matrix printers go. In terms of the graphics this machine produces, it's tough to beat for the price. Radio Shack has the CGP-220 listed with their Model 100 and Model 2000 as part of their Advanced Technology Series of products. ■

Programming with The Producer

by Hardin Brothers

The Producer won't land you a job in Hollywood, but it will let you create your own Basic data-handling programs with a minimum of bother. Even if you know nothing about programming, you can develop your own powerful data base managers. And if you're only moderately skilled in Basic, The Producer will create working program modules that you can easily add to your own software.

The longer I used The Producer, the more impressed I was. After only one month, it had found a place among my most-often-used software.

Using The Producer

The Producer comes in a hefty package that includes the documentation (several hundred pages) in a three-ring binder with reference dividers; a sample evaluation disk; the master disks, which include automatic backup routines; and a three-hour cassette tutorial, which helps you through any rough places in the documentation.

The easiest way to explain how The Producer works is to describe how you would use it to create a data-handling program. When you boot up the Producer's master disk, an Auto program reserves some high-memory space and runs the main program. When the menu comes up, you turn on the printer, press the A and I keys, and print a planning form.

Using the form, you pick the program's name, state its main purpose, list the fields you want included in each record, and make any calculations that your program will apply to those fields.

Then return to the main menu, format a disk, and start to define your program. The Producer comes with a stripped-down version of DOSPLUS 3.4 that you must use to create the program, although you can transfer the completed program to any DOS.

The Producer includes a more-than-adequate editor to create an input screen for your program. You can mix graphics and text, and add large-font letters, borders, message areas, and field areas.

When you're satisfied with the screen's appearance, The Producer

The Producer Professional Program Writer



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Easy to use? ★★★★★
Good docs? ★★★★★
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Does the job? ★★★★★

translates it into lines of Basic and then goes to a screen definition mode. It asks you to define the location and length of each of your fields, as well as the characters allowed for input for each. You must also define an area for The Producer to use for messages. There is an optional custom prompt area in which you can display messages that will help the program's operator respond to each field question.

After you draw and define the screen, you enter a mode called Edit Basic Data. Here you can create custom prompts for each of the fields defined earlier. These prompts will appear either when the program's user begins to enter data in each field or when he presses the clear key; the choice is yours.

Also, while in the edit mode, you define the calculations to be used on the numeric data in various fields. You may decide to either save the results of the calculations along with the rest of the information in each record or display the results for the user's benefit.

The First Draft

Finally, you're ready to create the first draft of the finished program. One of the selections from the main

Continued on p. 160

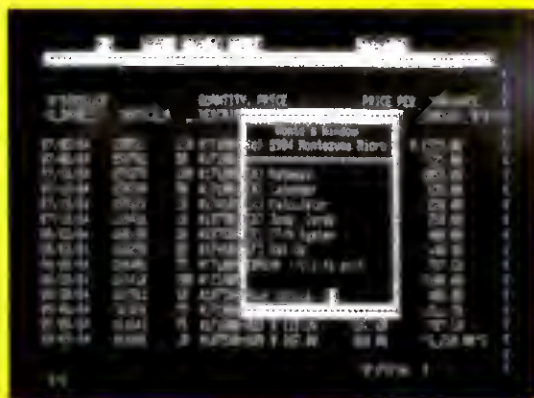
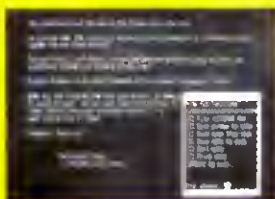


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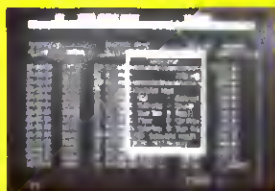
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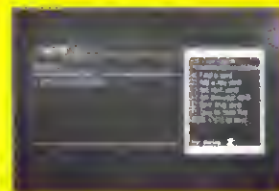


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Running Like the Wind

by Thomas L. Quindry

80's own Basic compiler is back and better than ever—it compiles more Basic commands and it's easier to use than our original version, and it now runs under any Model I/III DOS.

After hours of painstaking programming and debugging, you've come up with the ultimate arcade game—The Flying Slim Whitman Records—where you try to blast away the disks as they speed past you; “Una Paloma Blanca” garners a 500-point bonus. But when you run the program, the records move more slowly than they did up the *Billboard* charts.

Your problem lies with the way Basic executes program instructions: The Basic interpreter breaks down program statements into machine-language commands before executing them. You can circumvent this time-consuming process by running your program through a Basic compiler, a program that converts Basic statements to machine code. Since the compiler does some of the work of the Basic interpreter, the resultant program runs faster.

I wrote an enhanced version of Dr. Dimitri P. Bertsekas's Basic compiler (“A Basic Compiler in Basic,” October 1982, p. 122). My version, which I call FastBas, compiles more Basic commands, is easier to use, and runs under any DOS on the Models I and III. (For a comparison of FastBas with commercial compilers, see the sidebar.)

When FastBas converts Basic programs to machine language subroutines, programs run faster. Programs that use primarily integer arithmetic and graphics run 50–100 times faster, while programs written mostly in single-precision variables execute 3–20 times faster.

The programs you're compiling must stringently follow Basic programming rules for correct compilation. FastBas doesn't accept all Basic commands, but all compilable commands run in Basic. I

suggest running and debugging your program in Basic, then compiling it.

Compiler Basics

To understand how Basic compilers work and how they increase execution speed, you must first understand how your TRS-80 handles programming functions.

The TRS-80 ROM contains a machine-language program that interprets Basic programs line by line. If you run a line 1,000 times during the course of a program, the machine-language program interprets the statements in that line 1,000 times.

The Basic interpreter calls specific machine-language subroutines in ROM for each statement. Because of the extensive error-checking that takes place during this process, the program runs slow compared to machine-language programs.

A compiler, on the other hand, looks at each Basic statement once. It interprets the statement, then writes a machine-language subroutine for it and stores that subroutine in memory. The compiler then interprets the next statement and puts the machine-language subroutine in memory after the previous subroutine. Once the compiler changes all Basic statements to machine-language subroutines, you can save and run the compiled program.

How much faster compiled programs run varies with the nature of the program. Compiled programs still contain many inefficiencies in coding relative to bona fide machine-language programs.

Program Changes

I rewrote as few lines of the original program as possible and didn't renum-



ber it so that readers who have keyed in the original can modify their programs.

Lines 0-500 in Program Listing 1 contain a sample Basic program for you to compile. Note that the last line compiled must be an End statement.

Many of FastBas's subroutines appear before the main program to speed up compilation. The main program starts at line 1000.

Most of the statements I added are string functions. FastBas can compile the Basic commands to input a string value, and then find a string's VARPTR, ASC, and VAL. The program also interprets string concatenation (addition), and redefines strings from other string values. It also accepts Dimension (DIM) and Clear statements (see Tables 1-4 for a complete list of compilable statements and functions).

Program Listing 2 uses the string input function and the ASCII (ASC) function to let you answer yes/no questions. The ASCII function finds the ASCII value of the first character of the input string and acts on it using IF statements.

This program also exemplifies the use of the Dimension and Clear functions. FastBas accepts only one Dimension statement in the first line of the program you're compiling. You can, however, precede Dimension with a Clear statement, as in line 10.

For best results, put Clear and Dimension on a line separate from other program statements. Also, you can't GOTO the line containing the Dimension statement from within a compiled program.

Listing 2 also shows you how to use the Dimension statement in both Basic and compiled programs. The Dimension statement sets up the variable storage table and tells you how many of

each type of variable exist. In this sample, DIM A\$(40) tells the compiler that the program uses one string, A\$, and that the maximum string length is 40 characters. The equivalent statement in Basic (Run) sets up a string array with a dimension of 40.

Although Basic doesn't need a 40-string array, setting one up doesn't affect program execution, and you can test the Basic version before compiling it.

Program Listing 3 demonstrates how to use VARPTR (variable pointer) with PEEK and POKE commands to simulate uncompileable Length (LEN) and LEFT\$ functions. By using substitute programming techniques, you can simulate other uncompileable functions, such as RIGHT\$ and MID\$.

The VARPTR function identifies the memory location of each string used. As in Basic, the VARPTR function for strings points to a 3-byte table that gives the length of the string in the first byte and the location of the string in the next 2 bytes.

No specific string variable table exists for FastBas, so VARPTR creates a table for the requested string. FastBas always stores the table below the variable buffer in memory.

VARPTR moves the correct string length and location values to the 3-byte table. Only one VARPTR location is active at a time. Once the program in Listing 3 obtains the VARPTR, it stores the values at the VARPTR location in other variables before seeking another string location.

The Clear command clears all variables to zero. It's not needed at the beginning of the program you're compiling, since FastBas automatically zeros the variable storage area.

If you don't want variables automatically zeroed, make the USR call to your

compiled program 13 bytes higher than specified in the addresses given after compilation. This lets you compile several machine-language subroutines that the USR function calls from your Basic program. Each subroutine can then use the previously defined variables.

You can put the Clear command anywhere in the program you're compiling. FastBas ignores any digits after the Clear statement up to the colon or end of the program line (whichever comes first), but you can include them if they're necessary to run the uncompiled program. For instance, "Clear 200:" in the compiled program gives the same results as "Clear:" in the Basic version.

Compiling Basic Variables

FastBas accepts three variable types—integers, single-precision, and string variables—and you can't do much variable mixing. When using integer variables, the only way to include single-precision variables in the same statement is to use the integer (INT) function. FastBas allows only addition and subtraction with integer variables.

You must first define the values acted on within the functions PEEK, POKE, VARPTR, ASC, VAL, and so on as integer variables or integer numbers without using arithmetic operations. The values must be integer variables or integer numbers between -32767 and 32767 without arithmetic operations.

FastBas can perform close to a full set of mathematical operations with single-precision variables. This includes the four basic math functions plus exponents, logarithms, random numbers, trigonometric functions, and so on.

The hierarchy of FastBas's mathematical operations is not as sophisticated as in Basic. The order of a Basic mathematical evaluation is exponentiation, followed by multiplication and division, then addition and subtraction.

FastBas evaluates operations from right to left, using the order of parentheses. This simplified system speeds compilation, but requires careful use of

General Statements	Description
Clear	Integer value is optional
CLS	Clears screen
DIM	Same syntax as Basic except for strings (see text)
END	Mandatory statement to return to Basic from USR subroutine
GOSUB (line number)	
GOTO (line number)	
REM or '	
RETURN	

Table 1. General statements that can be compiled.

The Key Box



Models I and III
32K RAM Disk Basic
Cassette Basic

Basic Compiler Comparison

by Hardin Brothers

Compiler	Fast Bas	Accel 3/4	Bascom	Vivace!	WIBASIC	ZBasic 3.0
Available for Models	I/III All DOSes.	I/III All DOSes.	III/4; only supported on TRSDOS but appears to work with other DOSes.	III/4 TRSDOS only.	I/III All DOSes.	I/III/4; all DOSes plus Apple, IBM-PC, Model 2000, Lobo & CP/M80.
Source File Location	Lines 1-500 of compiler program.	In memory with Accel and Disk Basic.	On disk as an ASCII file.	On disk as a tokenized file.	In memory with WIBASIC compiler and interpreter.	In memory with ZBasic compiler & editor or on disk in tokenized form.
Compile to	Memory only.	Memory only.	Disk /REL file, then linked into a CMD file.	Disk file.	Memory or disk.	Memory or disk.
Compatible with Disk Basic	Moderate. Supports integer and single-precision only. Several commands not supported.	Complete. Compiles only those commands it can optimize. Leaves others for Basic interpreter.	Very high, with a few minor differences.	Complete, though the Model III version had sporadic problems with file commands.	Uses its own version of integer Basic that is different from TRS-80 Basic, especially error-trapping and file-handling.	Uses its own version of Basic that is similar to Disk Basic, plus extra commands including structured loops (Repeat/Until & While/Wend) and graphics commands.
Location of runtime? library	All necessary code compiled into each command.	Separate disk file.	Separate disk file.	Separate disk file.	Compiled into CMD program.	Compiled into CMD program.
Chaining with common variables	No program chaining possible.	Chaining possible but no variables can be passed.	Chaining with any or all variables passed.	Model 4 only.	Possible, but requires tricky programming.	Can merge source programs, can't chain.
Speed of compiled program †	Moderately fast.	Moderately fast.	Very fast.	Relatively slow. Model 4 version was slower than original Basic program in benchmark test.	Very fast.	Fastest of all compilers in benchmark tests.
Ease of use	Moderately easy to use.	Easiest to use and understand.	Several options in both compiler and linker can cause confusion at first. Compiled program can be easily linked to Fortran and MACRO-80 programs.	Easy to use except I found the program sometimes had difficulty reading its own protected disk.	Compiling is easy but programs can be difficult to develop because of differences between Basic and WIBASIC.	Easy to use and understand. Most differences between Basic and ZBasic are enhancements, and the syntax feels "normal."
Other Comments	Best choice for developing USR routines for your Basic programs.	Best feature is its ease of use. Requires both a runtime library and Disk Basic to run CMD program.	All math functions can be double-precision. Best choice for very large and complex programs that require chaining.	Supplied on protected disk. Slow execution speed of compiled programs. I found erratic bugs in both the compiler and completed programs.	Compiled programs are very fast. Requires learning a completely new version of Basic.	Speed of compiled programs and power of extensions to Basic make this a top choice for programs that do not require chaining. Source code compatibility with other computers may be a major asset for some.
Supplier & Cost	This issue of 80 Micro & Load 80	Allen Gelder Software \$99.95	Radio Shack \$195	WittSoft, Inc. \$49.95	WittSoft, Inc. \$49.95	Simutek Computer Products \$89.95

† Benchmark used for compilers except Fast Bas was a combination of all programs in "Marking Time" (May 1984, p. 100). Programs were run compiled and uncompiled under various DOSes and versions of Disk Basic.

parentheses for proper evaluation. The use of parentheses doesn't slow compiled programs.

The compiler accepts 26 integer variables, denoted A%-Z%, and 286 sim-

ple single-precision variables, denoted by A-Z, or by a letter followed by a single decimal digit. Possible simple single-precision variables are A, A0-A9, B, B0-B9, . . . Z, Z0-Z9.

You can represent one- and two-dimensional arrays using the letters A-Z. Two-dimensional arrays must be square. For example, array B with dimensions B(34,34) is acceptable, but B(34,35) is not.

Denote string variables using A\$-Z\$. The maximum length for each string is the same. The program uses the same maximum length for string literals in Print statements.

If FastBas doesn't find a Dimension statement in the first line of your program, it uses default values for all variables (see line 1010 of Listing 1). Regardless of the dimension, FastBas has a minimum of integer and single-precision values from A%-Z% and A, A0-Z, Z0, respectively.

The Dimension statement doesn't have to include all types of variables. FastBas zeros variables not included, in the case of arrays, or takes minimum values. The minimum simple single-precision variable value is a letter from A-Z.

The compiler sets strings A\$-Z\$ to a character length of 40 unless otherwise specified in the Dimension statement. I recommend that the string length remain at a minimum of 40 so you can use print statements in your program. You can specify a minimum of one string, A\$, with the Dimension statement.

You can dimension more than one variable of each type in one Dimension statement. This is so the equivalent Basic program doesn't cause an error.

Only the last variable specification of each type sets the maximum dimension. For instance, Dimension C(20,20), B(2,2) is permissible, although in the compiled program, the maximum two-dimensional array is B(2,2).

The program hasn't saved enough space to store the C array. Changing the Dimension statement so it compiles to Dimension B(2,2),C(20,20) saves space for both arrays. This is important, since FastBas doesn't check for illegal arrays.

FastBas doesn't error-check variables, either. This can produce problems or work to your advantage. In the case of the defaulted variable values, the program has reserved memory for one-dimensional and two-dimensional arrays.

FastBas stores all arrays sequentially and computes the location of each array value. You'll probably dimension the maximum array location to 20, but you can define larger arrays.

You can include an array with a max-

Integer Statements	Description
+ and -	The only math operations allowed with integer variables. Example: A% = A% + B% - 7
For...To...Next	Requires integer variable or integer number. Follow Next with the specified integer. Example: FOR N% = A% TO B% : ... : NEXT N% FOR N% = A% TO 10 : ... : NEXT N%
If...Then (Line number) Else	Any combination of =, <, > conditions are valid. Replace Then with GOTO or Then GOTO. Only specify line numbers after Then or GOTO. Any number of If...Then...Else statements can follow each other. Example: IFA% >= B% GOTO 400 IFA% >= 45 GOTO 400 ELSE IFA% < 30 GOTO 400
Input	Don't include strings in quotation marks. Example: Input A%
INT	Changes single-precision expression to integer expression. Computed value of single-precision expression must be between - 32767 and 32767. Example: A% = INT(R*256 - 65536)
Let	Optional. You can only define integer variables to an expression that includes single-precision when using INT. Example: LET A% = B% A% = B%
PEEK	Requires integer variable or integer number. Mathematical operations are not acceptable. Example: A% = PEEK(A%) A% = PEEK(- 450)
Point	Same as PEEK. Integers must be between 0 and 127, and 0 and 47 respectively. Example: A% = POINT(C%, 34) A% = POINT(23, 34)
POKE	Same as PEEK. Second Integer must be between 0 and 255. Example: POKE A%, B% POKE - 3445, B% POKE - 3445, 45
Print	You can mix integers, single precision, and strings, as well as messages between quotes. Example: PRINT "The answer is "; A% PRINT A%; B; " "; S\$
PRINT@	Location is integer variable or integer number between 0 and 1023. Otherwise same as Print. Example: PRINT@C%, "The answer is "; A% PRINT@320, A%; B; " "; S\$
Reset	Same as PEEK and Point. Example: RESET(C%, 34) RESET(23, 34)
Set	Same as PEEK. Example: SET(C%, 34) SET(23, 34)

Table 2. Integer statements that can be compiled. Integer statements except Let require definition to an integer variable and can't include math operations. They must be between - 32767 and 32767.

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imum dimension of A(60) in your program if you don't use arrays B and C. FastBas specifies the maximum letter for arrays as at least C, so dimensioning Z(20) accommodates a single array of A(520) just as easily as dimensioning

A(520). An example of this appears in the sample program in Listing 1.

The added commands for string input and for string concatenation don't check for string length. However, the original string definition function does

check, so the same rules apply as for arrays. If you expect a string to be twice as long as allocated due to these functions, don't use the next higher string variable.

Passing Variables

Two special functions, DEFUSR and USR, pass variables from Basic to a machine-language subroutine and back. You can use them to speed up a Basic program by having only part of it compile into a machine-language USR subroutine (see sample program in Listing 1).

A Basic program that calls the compiled subroutine starts at Line 10000. Line 10060 calls the machine-language subroutine compiled from lines 0-500. FastBas's DEFUSR function is in line 1310. Note that you must dimension the Basic portion of the program sufficiently when arrays pass back from the machine-language subroutine to Basic.

If the If statement condition has executed the Clear 50 command in line 1316, running the sample program (by pressing the enter key) results in the error message "Subscript out of range" in line 1340. To run the program, press the break key and type in RUN 10000.

Line 30 in the sample program instructs the compiler to write code to pass the variable N% to the USR subroutine using the statement N%=0+N%. Line 40 transfers the value of the A array in the same fashion.

After the USR subroutine performs its function, the redefined A array transfers back to Basic in line 140 by A(I%)=1*A(I%).

The values of the variables on the right side of each equation are from lines 10000-10090 in the uncompiled Basic part of the program. They don't have to be the same variable name as on the left of the equals sign in lines 30, 40, and 140, but I recommend using identical variable names to assure complete compatibility with the uncompiled program. To try the program in Basic, change line 10060 to GOSUB30 and change line 500 to RETURN.

Manipulations in Memory

FastBas doesn't compile in a fixed memory location, but determines where protected memory begins and compiles from that point. If the program exceeds memory limits, it lowers the high memory pointer (HIMEM) by 512 bytes and restarts compilation. This process

Single-precision Commands +, -, *, /, and [(exponent)	Description
ABS	Accepted math operations. Can include single-precision expressions with integer variables. Placement of parentheses is important. Example: A = A%*B - ((C/7)[2])
ATN	Can use single-precision expressions, single-precision variables, or integer variables in parentheses. Example: A = ABS(4*B% - 76)
COS	Same as ABS. Example: A = ATN(4*B% - 76)
EXP	Same as ABS. Example: A = COS(4*B% - 76)
If...Then (Line number) Else	Any combination of =, <, > conditions are valid. Can replace Then with GOTO or Then GOTO. Only specify line numbers after Then or GOTO. Any number of If...Then...Else statements can follow each other. If first value is an integer variable, it must follow rules for integers. Example: IFA>=B%GOTO 400 IFA>=45*3GOTO400ELSEIFA< CGOTO400IFA>=45*3THEN400 ELSEIFA<CTHEN400
Input	Don't put quotation marks around string expressions in Input commands. Example: Input A
Let	Optional command. Can define single-precision variables to an expression that includes integer expressions. Don't include integer commands in the expression, only integer variables and single-precision variables and expressions. Placement of parentheses crucial for correct evaluation. Example: A = 50 + TAN(355/(113*4)) + (A%*256)
LOG	Same as ABS. Example: A = LOG(4*B% - 76)
Print	Same as integer Print. (Table 2)
PRINT@	Same as integer PRINT@. (Table 2)
RND(0)	Random number greater than 0 and less than 1. Example: A = RND(0)*10
SIN	Same as ABS. Example: A = SIN(4*B% - 76)
SQR	Same as ABS. Example: A = SQR(4*B% - 76)
TAN	Same as ABS. Example: A = TAN(4*B% - 76)

Table 3. Single-precision functions that can be compiled. These functions can use math operations.

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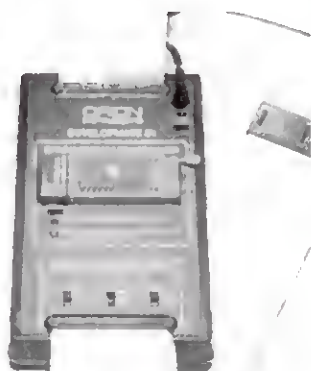
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String Commands	Description
ASC	ASCII value of a string. Example: A% = ASC(D\$)
CHRS	Requires integer variable or integer number in parentheses. Example: B\$ = CHR\$(A%) + CHR\$(65)
Input	Don't include string expressions in quotation marks. No error-checking for string length. Example: Input A\$
Let	Optional command. Can define string variables as string expressions that include string concatenation and redefinition. No error-checking in string length occurs for concatenation and redefinition. Example: A\$ = B\$ A\$ = "First String" + CHR\$(C%) + "B\$"
Print	Same as integer Print. (Table 2)
PRINT@	Same as integer Print@. (Table 2)
VAL	Compiler truncates any decimal value to an integer. Example: A% = VAL(D\$)
VARPTR	Example: A% = VARPTR(D\$)

Table 4. String functions that can be compiled. You can define many string commands with integer variables.

Program Listing 1. FastBas and sample Basic compilation program.

```

0 ' *** PROGRAM LINES 10-500 AND 10000-10090 ARE A SAMPLE PROGRAM
READY FOR COMPILE. RUN 1000 TO COMPILE.
10 ' *** NUMERICAL ARRAY SORTING (FROM LEVELII MANUAL)
20 ' *** PASS ARRAY A FROM BASIC TO USE ***
30 N%=0+N%
40 FOR I%=1 TO N%:I%=1*I%:A(I%)=0+A(I%):NEXT I%
50 ' *** SORTING PROGRAM BEGINS ***
60 D%=1
70 D%=D%+D%:IFD%<N%THEN70
80 D%=INT((D%-1)/2):IFD%=0 THEN 140
90 T%=N%-D%:FORI%=1TOT%:J%=I%
100 L%=J%+D%:IFA(L%)>A(J%) THEN 120
110 T=A(J%):A(J%)=A(L%):A(L%)=T:J%=J%-D%:IFJ%>0 THEN100
120 NEXTI%:GOTO00
130 ' *** PASS ARRAY A FROM USER TO BASIC ***
140 FOR I%=1 TO N%:I%=1*I%:A(I%)=1*A(I%):NEXT I%
500 END
501 '***** BASIC COMPILER *****
502 '** COPYRIGHT 1901 BY D. P. BERTSEKAS, BELMONT, MASS.
503 '** PERMISSION TO USE; NOT TO SELL
505 '** ENHANCEMENTS 1904 BY T. L. QUINDRY, BURKE, VA.
506 '**
510 '***** PEEK & POKE ROUTINES *****
512 POKE,P:PRINTP;M=M+1:IFM<-12-MH*16304TBENRETURNELSECLS:PRINT0
320,"PROGRAM HAS EXCEEDED PROTECTED MEMORY SIZE"
513 PRINT:PRINT"LOCATION TO COMPILE LOWERED BY 512 BYTES AND PROGR
AM BEING RERUN":POKE16562,PEEK(16562)-2:PORN=1T02000:NEXT:GOTO1000
514 PC=PEEK(Q):PN=PEEK(Q+1):Q=Q+1:IFPC=32THEN514ELSEIFPC=0C=2:RETU
RNELSERETURN
510 IFPC<65ORPC>90THEN522ELSERETURN
520 IFPN<>37THEN522ELSEQ=Q+1:RETURN
522 PRINT:PRINT"ERROR LINE #";L1(L-1):END
524 PRINT0,FS;:PRINT064,CHR$(30):RETURN
529 ' ***** SINGLE PRECISION ASSIGNMENT ROUTINES *****
530 ' ROUTINE TO FIND VAR. ADDRESS PARAMETERS
535 GOSUB514:GOSUB510:V1=PC-65:IFPN<40ANDPN>57ANDPN<>213ANDPN<>40A
NDOCF<>1THEN522
530 IFPN>47ANDPN<50MI=PN-47:GOSUB514ELSEMI=0
540 IFPN=213Z1=1:RETURN

```

Listing 1 continued

repeats until the program reaches a minimum HIMEM limit or until the program completely compiles.

The variable storage area is located above the compiled program and extends down from the top of memory as needed. All compiled subroutines use the same variable table area, so if you put more than one compiled program in memory, write the Dimension statement to accommodate the largest compiled subroutine.

If interference from the top of the compiled program and the allocated variable table area occurs during compilation, FastBas relocates the compiled program, corrects its jump addresses to accommodate the allocated area for variable storage, and corrects the HIMEM pointer.

Compilation can occur too low for the compiler to work. If the HIMEM pointer is too low in memory, FastBas adjusts it upwards and the program compiles at the higher memory position.

FastBas requires about 1,650 bytes above the Basic program to run. However, if FastBas relocates the HIMEM pointer to the minimum allowable value and you get an out-of-memory error, change the value + 1650 in line 1007 to a higher value.

Compilable Commands

Tables 1-4 list and define compilable Basic commands and explain how to use them. Table 1 lists general statements that compile. Table 2 lists the compilable integer statements. Table 3 lists compilable single-precision commands, and Table 4 contains compilable string commands.

Remember that functions that apply to integer variables give integer results, and the values that go within parentheses of the functions must be integer values or integer variables.

FastBas can't carry out arithmetic functions within parentheses when using the special integer functions, and has limited error-checking for this type of error. If FastBas finds an illegal operation, it ignores any remaining expressions on that program line.

Array locations must be integer variables. Functions that apply to single-precision variables can have single-precision variables, integer variables, or single-precision expressions within the parentheses of the function.

Using FastBas

To compile a Basic program, number the program lines from 0-500 and continue it from line 1000 if necessary. Save the program in ASCII, then merge it with FastBas. Delete the lines relating to the sample program, then type RUN 1000 to compile the program.

As an example, try compiling Pong in Program Listing 4. This two-player paddle game demonstrates how much faster compiled code runs compared to a Basic program.

Try running the Basic version first. Use the O and L keys to move the right paddle and the Q and A keys for the left paddle. The game stops when a player gets 16 points. The highest ball speed setting moves very slowly. The compiled program runs so fast that the highest speed setting is impossible.

After you've merged your Basic program and run FastBas, it displays each Basic line number and the compilation address (except for the line containing the Dimension statement), followed by all code in decimal. A colon separates each statement in the line.

By changing the Print statements in lines 512 and 1035 of Listing 1 to LPRINT statements, you can trace where each command compiles in memory.

FastBas's last display indicates the hexadecimal (hex) and decimal values for the start, end, and transfer address of the compiled program, along with the location of the compiled program and the variable table (see the Figure).

In this last screen you have all the information needed to save and run the compiled program or subroutine. Use the start, end, and transfer hex addresses with the Dump command to save the program to disk (see your DOS manual for correct syntax).

When entering Basic, you must protect high memory or your compiled program will crash. Use the decimal notation in the second row under the column labeled Start. When in Basic, define the USR function (DEFUSR) by using the third row value under Start. This is always a negative value.

To load the compiled program into memory, type in LOAD followed by a file name from DOS Ready and hit the enter key. If you're using another DOS, use the equivalent statement. You can save the program using the CMD "L" command from Basic. Be sure to in-

COMPILED PROGRAM CONFLICTS WITH VARIABLE STORAGE AREA.
RELOCATING PROGRAM . . .

33 252 249 17 252 247 1 167 5 237 176 201
PROTECTED MEMORY POINTER CHANGED AND PROGRAM RELOCATED TO

	START	END	TRANSFER
HEXIDEIMAL	&HF7FC	&HFDA3	&HF7FC
DECIMAL	63484	64931	63484
DECIMAL	-2052	-605	-2052

VARIABLES STORED - &HFE3F
TO TOP OF MEMORY - &HFFFF

<ENTER> TO RUN MACHINE CODE . . . ?

Figure. Final display after compiling the Pong program.

Listing 1 continued

```

545 IFPN=48GOSUB514:GOSUB514:GOSUB514:V2=PC-65:GOSUB520:GOSUB514EL
SEIFCP=121=1:RETURN
550 IFPC<>41ANDPC<>44THEN522
555 IFPC=41Z1=2:RETURN
560 IFPC=44GOSUB514:GOSUB514:V3=PC-65:IFV1<0ORV1>=NTTHEN522ELSEGOS
UB520:Z1=3:GOSUB514:IFPC<>41OR(PN<>213ANDCF<>1)THEN522ELSERETURN
564 ' ADDRESS COMPUTATION ROUTINE
565 ONZ1GOSUB570,575,580:RETURN
570 IPNI>ISTHEN522ELSECL=VF+(V1+M1*26)*4:GOSUB836:GOSUB902:RETURN
575 V7=V1:V0=V2:GOSUB610:RETURN
580 V7=V1:V0=V2:V9=V3:GOSUB620:RETURN
600 ' ARRAY PORTION OF ADDRESS ROUTINE
610 V0=V0:GOSUB912:GOSUB906:C1=VA+V7*DO*4:GOSUB836:GOSUB900:GOSUB9
04:RETURN: ' 1-D ARRAY
620 V0=V9:GOSUB912:P=41:GOSUB512:C1=VD+4*NT*OT*DT+2*V7*DT:GOSUB836
:GOSUB900:GOSUB904:P=94:GOSUB512:P=35:GOSUB512:P=06:GOSUB512:V0=V0
:GOSUB912:GOSUB906:GOSUB904:RETURN: ' 2-D ARRAY
699 ' ROUTINE TO EVALUATE SINGLE PRECISION EXPRESSIONS
700 GOSUB514:IFPC<>20GOTO704
702 E1=0:D1=0:GOSUB902:GOSUB926:GOSUB926:GOTO714:'TAKES CARE OF LE
ADING <-> SIGN
704 GOSUB730
706 GOSUB514:IFC=20RPC=41ORPC=58ORPC=59ORPC=212ORPC=213ORPC=214ORP
C=141ORPC=202THENRETURN:'PEEK NEXT BYTE; IF TERMINATOR RETURN
708 GOSUB934:'MOVE INTERIN RESULT FROM 4121B STORAGE AREA TO STACK
710 ' MOVE NEW VARIABLE TO 4121B AREA; POP BC0E; OPERATE
712 IFPC=205GOSUB514:GOSUB730:GOSUB936:GOSUB940:GOTO706:'ADO
714 IFPC=206GOSUB514:GOSUB730:GOSUB936:GOSUB942:GOTO706:'SUBTRACT
716 IFPC=207GOSUB514:GOSUB730:GOSUB936:GOSUB944:GOTO706:'MULTIPLY
718 IFPC=208GOSUB514:GOSUB730:GOSUB936:GOSUB946:GOTO706:'DIVIOE
720 IFPC=209GOSUB514:GOSUB730:GOSUB936:GOSUB940:GOTO706:'EXPONENTI
ATE
722 GOTO522:'ERROR TRAP
729 ' ROUTINE TO EVALUATE CONSTANTS, VARIABLES & FUNCTIONS IN SING
LE PRECISION EXPRESSION & MOVE THEM TO 4121B STORAGE AREA
730 IF(PC<50ANDPC>47)ORPC=46GOSUB845:RETURN:'CONVERT CONSTANT TO 4
-BYTE REPRESENTATION; MOVE IT & RETURN
732 IFPC=222GOSUB514:IFPC<>40THEN522ELSEGOSUB514:IFPC<>40THEN522EL
SEGOSUB514:IFPC<>41THEN522ELSEP=205:GOSUB512:P=240:GOSUB512:P=20:G
OSUB512:RETURN:'RND(0)
734 IF(PC<220ANDPC<229)ORPC=217ORPC=40THEN756ELSEIFPC<65ORPC>90THE
N522:'IF FUNCTION GOTO 750
736 V4=PC-65:IFPN>47ANDPN<58THENNE=PN-47:GOSUB514:Z2=1:GOTO746ELSE
IFPN<>40ANDPN<>37THENNE=0:Z2=1:GOTO746ELSEIFPN=37THENZ2=4:GOSUB514
:GOTO746
738 GOSUB514:GOSUB514:GOSUB514:V5=PC-65:GOSUB520:GOSUB514
740 IFPC<>41ANDPC<>44THEN522
742 IFPC=41Z2=2:'1-D ARRAY
744 IFPC=44GOSUB514:GOSUB514:V6=PC-65:GOSUB520:Z2=3:GOSUB514:IFPC<
>41THEN522:'2-D ARRAY
746 ONZ2GOTO740,750,752,754
748 IPNE>ISTHEN522ELSECL=VF+(V4+NE*26)*4:GOSUB836:GOSUB902:GOSUB93
2:RETURN
750 V7=V4:V0=V5:GOSUB610:GOSUB932:RETURN
752 V7=V4:V0=V5:V9=V6:GOSUB620:GOSUB932:RETURN
754 V0=V4:GOSUB912:P=34:GOSUB512:P=33:GOSUB512:P=65:GOSUB512:P=205

```

Listing 1 continued

clude the /CMD extension in the filename if you save the program this way.

Model I TRSDOS doesn't have an equivalent command to load from Basic; load from DOS instead. If you use Model III TRSDOS and the Dump command, return to DOS by rebooting instead of using CMD "S".

If the compiled program contains an INPUT\$ function and the string is more than four characters long, calling the

routine from the Basic command mode instead of from a Basic program results in a syntax error on return to Basic. However, this doesn't affect operation of the compiled program.

If you compiled Pong, the final screen should look like that in the Figure. Assuming you're using TRSDOS 1.3, you then reboot the computer and type in DUMP PONG (START=0F7FC,END=0FDA3,TRA=0F7FC)

and hit the enter key to save the compiled program.

To load Pong, type in LOAD PONG/CMD from DOS, hit the enter key, type in BASIC - M:63484, hit the enter key, and type in DEFUSR=-2052:A=USR(0) and hit the enter key. The compiled program starts running immediately.

Troubleshooting

FastBas checks for some syntax errors during compilation. However, other errors go undetected until you try to run the program.

If the compiled program runs but gives different results than its Basic equivalent, check arithmetic operations. The compiler and the interpreter carry out the order of arithmetic operations in a single-precision variable differently. Check also if a machine-code variable appears in the right side of an assignment statement before it's initialized.

If the compiled program crashes, check the For...Next loops; make sure they're set up properly and that the program doesn't jump out of a loop.

Modifications

Analyzing the code in memory with a disassembler provides many clues to machine-language programming. For example, you can examine single-precision math routines and write similar code in your programs using the compiled routines as a guide.

All essential statements used in writing FastBas are in the list of compilable statements, so it's possible to rewrite the entire compiler and structure it so the program can compile itself.

However, the size of the Basic program that you must write, the number of GOTO and GOSUB statements, and the size of the resulting code might make it impractical.

Also, you'd have to change many of the variables to single-precision to have the program compile itself, so an increase in speed of more than three times is unlikely.

It's an intriguing project, however, and I'll leave that as a challenge to anyone who cares to try. ■

Thomas L. Quindry is an Associate Editor of 80 Micro. Contact him at TLQ Enterprises, 6237 Windward Drive, Burke, VA 22015.

Listing 1 continued

```
:GOSUB512:P=204:GOSUB512:P=18:GOSUB512:RETURN:' CONVERT INTEGER VA
R. TO SINGLE PRECISION
756 IFPC=48THEN776:'PARENTHESIS
758 Q=Q+1
760 IFPC=221THEN770:'SQR
762 IFPC=217THEN780:'ABS
764 IFPC=223THEN782:'LOG
766 IFPC=224THEN784:'EXP
768 IFPC=225THEN786:'COS
770 IFPC=226THEN788:'SIN
772 IFPC=227THEN790:'TAN
774 IFPC=228THEN792:'ATH
776 GOSUB700:GOTO794
778 GOSUB700:GOSUB952:GOTO794
780 GOSUB700:GOSUB954:GOTO794
782 GOSUB700:GOSUB956:GOTO794
784 GOSUB700:GOSUB958:GOTO794
786 GOSUB700:GOSUB960:GOTO794
788 GOSUB700:GOSUB962:GOTO794
790 GOSUB700:GOSUB964:GOTO794
792 GOSUB700:GOSUB966
794 IFPC<>41THEN522
796 RETURN
800 ' ***** CONVERSION ROUTINES *****
801 ' ROUTINE TO FIND LSB & MSB OF INTEGER NUMERIC STRING
818 C$="":IFPC=206THENPC=45:GOSUB018ELSEGOSUB016:IFC$=""THENC1=-1:
RETURN
812 C1=VAL(C$)
814 D1=C1/256:E1=C1-D1*256:IFC1<0THEND1=D1+256:C1=-C1:RETURN:ELSER
ETURN
816 IFPC<48ORPC>57THENRETURN
818 C$=C$+CHR$(PC):GOSUB514:GOTO816
835 ' ROUTINES TO FIND LSB & MSB OF ADDRESSES ABOVE 1ST 32K
836 D1=C1/256:E1=C1-D1*256:D1=D1+256:RETURN
848 Z=VT+V1+V1:P1=Z/256:P=Z-P1*256:P1=P1+256:RETURN
844 ' ROUTINE TO CONVERT NUMERIC STRING TO 4-BYTE SINGLE PRECISION
REPRESENTATION
845 C$=C$+CHR$(PC)
846 GOSUB514:IF(PC<58ANDPC>47)ORPC=46C$=C$+CHR$(PC):GOTO846
847 R=VAL(C$):GOSUB848:E1=33:D1=65:GOSUB902:C1=83:GOSUB910:P=35:GO
SUB512:C1=B2:GOSUB910:P=35:GOSUB512:C1=B1:GOSUB918:P=35:GOSUB512:C
1=B2:GOSUB918:Q=Q-1:RETURN
848 IFR=0THENBE=0:B1=0:B2=0:B3=0:RETURN
849 Y1=1:Y2=2:N=1:IFY1>RTHEN852
850 IFY2<=RTHENY1=Y1+Y1:Y2=Y2+Y2:N=N+1:GOTO850
851 GOTO853
852 IFR<Y1THENY1=Y1/2:Y2=Y2/2:N=N-1:GOTO852
853 BE=N+120:X1=0:R=R-Y1:GOSUB856:B1=B
854 GOSUB857:X1=X:GOSUB856:B2=B
855 GOSUB857:X1=X:GOSUB856:B3=B:RETURN
856 GOSUB857:X2=X:GOSUB857:X3=X:GOSUB857:X4=X:GOSUB857:X5=X:GOSUB8
57:X6=X:GOSUB857:X7=X:GOSUB857:X8=X:B=X1+X1+X2:B=B+B+X3:B=B+B+X4:B
=B+B+X5:B=B+B+X6:B=B+B+X7:B=B+B+X8:RETURN
857 Y1=Y1/2:RT=R-Y1:IFRT<0X=0:RETURN:ELSEX=1:R=RT:RETURN
879 ' ROUTINE TO POKE STRING IN TEMPORARY STORAGE AREA
888 C1=NF:GOSUB836:GOSUB900:NN=1
881 IFPC=34GOSUB890:RETURN
882 GOSUB889
883 IFPP=1ANDPEEX(Q)=32Q=Q+1:PC=32:NN=NN+1:GOTO885
884 GOSUB514:NN=NN+1
885 IFPP=1AND(PC=34ORC=2)GOSUB890:RETURN
886 IFPP=0AND(PC=58ORC=2)GOSUB890:RETURN
888 GOTO882
889 P=62:GOSUB512:P=PC:GOSUB512:P=18:GOSUB512:IFPC<>0THENP=19:GOSD
```

Listing 1 continued

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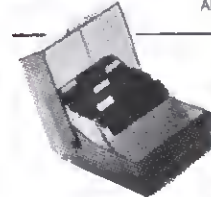


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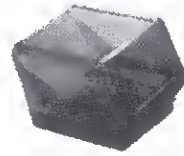
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Listing 1 continued

```
B512:RETURN:ELSERETURN
898 Q=Q-1:C=8:PC=8:GOSUB889:IFPN>SLTHENPRINT:PRINT"STRING TOO LONG
":GOTO522:ELSERETURN
B99 ' ***** FREQUENTLY USED MACHINE CODES *****
988 P=17:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:RETURN:'LD DE,E1D1
982 P=33:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:RETURN:'LD HL,E101
984 P=25:GOSUB512:RETURN:'ADD HL,DE
986 P=41:GOSUB512:P=41:GOSUB512:RETURN:' ADD HL,HL; ADD NL,RL
988 P=235:GOSUB512:RETURN:' EXC HL,DE
918 P=54:GOSUB512:P=C1:GOSUB512:RETURN:'LD (HL),C1
912 C1=VT+V8+V8:GOSUB836:P=42:GOSUB512:P=E1:GOSUB512:P=01:GOSUB512
:RETURN:' LD HL,(C1)
914 P=42:GOSUB512:GOSUB848:GOSUB512:P=P1:GOSUB512:RETURN:'LD HL,(P
1P)
916 P=34:GOSUB512:GOSUB848:GOSUB512:P=P1:GOSUB512:RETURN:'LD (PP1)
,HL
918 P=195:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:RETURN:'JP E1D1
928 P=183:GOSUB512:P=237:GOSUB512:P=82:GOSUB512:RETURN:'OR A; SBC
HL,DE
922 P=48:GOSUB512:P=3:GOSUB512:RETURN:'JR Z,3
924 P=225:GOSUB512:RETURN:'POP HL
926 P=229:GOSUB512:RETURN:'PUSH HL
928 P=289:GOSUB512:RETURN:'POP DE
938 P=213:GOSUB512:RETURN:'PUSH DE
932 P=285:GOSUB512:P=177:GOSUB512:P=9:GOSUB512:RETURN:'MOVE VARIAB
LE TO 4121H AREA
934 P=285:GOSUB512:P=164:GOSUB512:P=9:GOSUB512:RETURN:'MOVE FROM 4
121H TO STACK
936 P=193:GOSUB512:GOSUB928:RETURN:'POP BC & DE
938 ' ARITHMETIC OPERATION & FUNCTION ROUTINES
948 P=285:GOSUB512:P=22:GOSUB512:P=7:GOSUB512:RETURN
942 P=285:GOSUB512:P=19:GOSUB512:P=7:GOSUB512:RETURN
944 P=285:GOSUB512:P=71:GOSUB512:P=8:GOSUB512:RETURN
946 P=285:GOSUB512:P=162:GOSUB512:P=8:GOSUB512:RETURN
948 P=285:GOSUB512:P=247:GOSUB512:P=19:GOSUB512:RETURN
958 P=285:GOSUB512:P=12:GOSUB512:P=18:GOSUB512:RETURN
952 P=285:GOSUB512:P=231:GOSUB512:P=19:GOSUB512:RETURN
954 P=285:GOSUB512:P=239:GOSUB512:P=18:GOSUB512:P=285:GOSUB512:P=1
19:GOSUB512:RETURN
956 P=285:GOSUB512:P=9:GOSUB512:P=8:GOSUB512:RETURN
958 P=285:GOSUB512:P=57:GOSUB512:P=28:GOSUB512:RETURN
968 P=285:GOSUB512:P=65:GOSUB512:P=21:GOSUB512:RETURN
962 P=285:GOSUB512:P=71:GOSUB512:P=21:GOSUB512:RETURN
964 P=285:GOSUB512:P=168:GOSUB512:P=21:GOSUB512:RETURN
966 P=285:GOSUB512:P=189:GOSUB512:P=21:GOSUB512:RETURN
968 P=285:GOSUB512:P=167:GOSUB512:P=48:GOSUB512:RETURN
978 P=62:GOSUB512:P=4:GOSUB512:P=58:GOSUB512:P=175:GOSUB512:P=64:G
OSUB512:RETURN
972 P=285:GOSUB512:P=203:GOSUB512:P=9:GOSUB512:RETURN
999 ' ***** MAIN PROGRAM *****
1088 CLEAR288:DEFINTA-P,S-X,Z:DIHL(188),L2(188),A(58),A1(58),O(25
),E(25):FS="BASIC COMPILER"+STRING$(58," "):TS=CHR$(32)+CHR$(58)+C
HRS(32):CLS
1885 Q=PEEK(16548)+256*PEEK(16549):L=1:K=8:FP=B:CF=B:MC=PEEK(16561
)+PEEK(16562)*256+3-65536:M=MC:MR=0:IF YOU HAVE A 32K SYSTEM, MAKE
MR=1; ELSE IF YOU HAVE A 48K SYSTEM, MR=8
1807 FN=PEEK(16633)+PEEK(16634)*256+1658-65536:IFFN>MCTHENCL=FN-3:
GOSUB814:PRINT8512,"LOCATION TO COMPILE CHANGED TO PROTECT BASIC P
ROGRAM":FORN1=1TO288:NEXT:POKE16561,E1:POKE16562,D1:GOTO1888
1818 IS=18:DO=28:DT=28:SL=48:NO=26:NT=26:IS=# OF ADDITIONAL
S.P. VARIABLES PER LETTER; DO=DIM OF 1-D ARRAYS; DT=DIM OF 2-D ARR
AYS; SL=LENGTH OF STRINGS; NO=# OF 1-D ARRAYS ALLOWED; NT=# OF 2-D
ARRAYS ALLOWED; NS=# OF STRINGS ALLOWED
1811 Q1=Q:Q=Q+4:GOSUB514:IFPC=184THENGOSUB7188' CLEAR
1812 IPFC=138TBENGOSUB7118:IFIS=8TBENIS=1'DIM
1813 Q=Q1:PRINT8448,"IS"=IS:PRINT"DO"=DO:PRINT"DT"=DT:PRINT"SL
"=SL:PRINT"NO"=NO:PRINT"NT"=NT:PRINT"NS"=NS
1815 VT=-2*26-MR*163B4:VP=-4*26*(1+IS)+VT:VA=-4*NO*OO+VF:VD=-4*NT*
DT*DT-2*NT*OT+VA:VS=-NS*(SL+1)+VD:VN=- (SL+1)+VS:PRINT856,"ZERO VA
RIABLES":GOSUB7136' CLEAR
1828 ' MC=END OF VARIABLE STORAGE AREA AND ALSO THE START OF MACHI
NE CODE; VT=START OF INTEGER STORAGE; VF=START OF SIMPLE VARIABLE
STORAGE; VA=START OF 1-D ARRAY STORAGE; VD=START OF 2-D ARRAY STOR
AGE; VS=START OF STRING STORAGE; VN=TEMP. STORAGE
1821 IFPN>8GOSUB7888:' GENERATE CODE TO STORE 2-D ARRAY ADDRESSES
1825 N1=PEEK(Q)+PEEK(Q+1)*256:L1(L)=PEEK(Q+2)+PEEK(Q+3)*256
1838 GOSUB524
1835 PRINT:PRINT8968," LINE #":L1(L),H,"":":":L2(L)=H:L=L+1:Q=Q+4
1848 IFLL(L-1)>588TBEN1218
1845 C=8:GOSUB514:IPC=2TBEN1148
1858 IPFC=133ORPC=134ORPC=136OR(PC>137ANDPC<148)ORPC=142ORPC=144OR
PC=148OR(PC>149ANDPC<177)OR(PC>178ANDPC<184)OR(PC>184ANDPC<189)OR(
PC>189ANDPC<282)ORPC=283ORPC=284ORPC=218ORPC=211TBEN522:' ERROR TRA
P
1855 IPFC=215OR(PC>216ANDPC<221)OR(PC>228ANDPC<251)TBEN522:' ERROR
TRAP
1856 IPFC=184GOSUB7135' CLEAR
1857 IPFC=148GOSUB514:' LET
```

Listing 1 continued

```

1060 IFPC>64ANDPC<91ANDPN=370=Q-1:GOSUB2000:' INTEGER LET
1065 ' SINGLE PRECISION LET
1070 IFPC>64ANDPC<91ANDPN<>37ANDPN<>36Q=Q-1:GOSUB535:GOSUB514:GOSU
B514:IF(PC=49ANDPN=207)OR(PC=40ANDPN=205)GOSUB4000:ELSEQ=Q-2:GOSUB
514:IFPC<>213THEN522ELSEGOSUB700:GOSUB565:GOSUB972
1075 IFPC>64ANDPC<91ANDPN=36Q=Q-1:GOSUB4500:' STRING LET
1080 IFPC=170GOSUB2500:' PRINT
1085 IFPC=141GOSUB3500:' GOTO
1090 IFPC=143GOSUB3000:' IF ... THEN
1095 IFPC=145GOSUB3700:' GOSUB
1100 IFPC=146GOSUB3000:' RETURN
1105 IFPC=132THENP=205:GOSUB512:P=201:GOSUB512:P=1:GOSUB512:GOSUB5
14:IFPC<>50ANDC<>2THEN522:' CLS
1110 IFPC=137GOSUB2700:' INPUT
1115 IFPC=129GOSUB5000:' FOR
1120 IFPC=135GOSUB5500:' NEXT
1125 IFPC=130ORPC=131GOSUB6000:' SET & RESET
1127 IFPC=177GOSUB6500:' POKE
1130 IFPC=120P=205:GOSUB512:P=157:GOSUB512:P=10:GOSUB512:P=201:GOS
UB512:' END
1135 IFPEEK(Q-1)=50ORPEEK(Q-1)=149PRINTT$;GOTO1045:' TEST FOR TER
MINATOR & ELSE TOKEN
1140 Q=M1:PRINT:GOTO1025:' START NEW LINE
1200 ' ***** ROUTINE TO ADJUST THE MACHINE CODE JUMPS *****
1210 GOSUB524:IFK=0THEN1250ELSEPRINT@960,"ADJUSTING JUMP ADDRESSES
...";
1220 FORI=1TOK:DN=PEEK(A(I))+256*PEEK(A(I)+1):DH=0
1230 FORJ=1TOL:IFDN=L1(J)THENDH=L2(J):PRINTL1(J);
1240 NEXTJ:C1=0H:GOSUB036:POKEA(I),E1:POKEA(I)+1,D1:NEXTI
1250 CLS:IFVN=3>MTHEN1310ELSESTR=M-VN+3:MO=TR/256:IFTR<MO*256THENM
O=MO+1
1260 PRINT:PRINT"COMPILED PROGRAM CONFLICTS WITH VARIABLE STORAGE
AREA."
1280 IFMC-MO*256>FMTHENGOTO1206ELSEPRINT:PRINT"TO RECOMPILE PROGRA
M IN LOWER MEMORY WOULD OVERWRITE YOUR":PRINT"BASIC PROGRAM. TRY T
O REDUCE THE VARIABLE STORAGE AREA BY":PRINT"REDIMENSIONING VARIAB
LES. PROTECTED MEMORY HAS BEEN MOVED TO"
1205 PRINT"THE MINIMUM VALUE TO ALLOW THE BASIC COMPILER TO RUN.":
C1=FM-3:GOSUB014:POKE16561,E1:POKE16562,D1:END
1206 PRINT"RELOCATING PROGRAM . . .":M2=M:P=33:GOSUB512:C1=MC:GOSU
B014:P=E1:GOSUB512:P=D1:GOSUB512:P=17:GOSUB512:P=E1:GOSUB512:P=D1-
MO:GOSUB512:P=1:GOSUB512:C1=M2-MC:GOSUB014:P=E1:GOSUB512:P=D1:GOSU
B512
1207 P=237:GOSUB512:P=176:GOSUB512:P=201:GOSUB512:DEFUSR1=M2:MC=MC
-MO*256:M=M-MO*256-12
1208 IFK1>0THENFORI=1TOK1:POKEA(I),PEEK(A(I))-MO:NEXTI
1209 IFK>0THENFORI=1TOK:POKEA(I)+1,PEEK(A(I)+1)-MO:NEXTI
1290 PRINT:PRINT"PROTECTED MEMORY POINTER CHANGED AND PROGRAM RELO
CATED TO":GOTO1310
1299 ' ***** ROUTINE TO EXECUTE THE MACHINE CODE DIRECTLY *****
*
1300 GOSUB014:E2=E1/16:O2=D1/16:E1=E1-E2*16:D1=D1-D2*16:IFD2>9TBEN
D2=D2+55ELSED2=D2+40
1301 IFD1>9THEND1=D1+55ELSED1=D1+40
1302 IFE2>9THENE2=E2+55ELSEE2=E2+40
1303 IFE1>9THENE1=E1+55ELSEE1=E1+40
1304 B$="&H"+CHR$(D2)+CHR$(D1)+CHR$(E2)+CHR$(E1):PRINTB$,:RETURN'C
ONVERSION TO HEX
1310 DEFUSR0=MC:PRINT@304,"START","END","TRANSFER":PRINT"HEXIDECI
MAL",C1=MC:GOSUB1300:C1=M:GOSUB1300:C1=MC:GOSUB1300:PRINT"DECIMAL
"TAB(15)65536+MCTAB(31)65536+MTAB(47)65536+MC:PRINT"DECIMAL",MC,M,
MC:PRINT
1315 PRINT"VARIABLES STORED - ";C1=VN-3:GOSUB1300:PRINT:PRINT"TO
TOP OF MEMORY - ";C1=-MR*16304-1:GOSUB1300:PRINT
1316 IFTR<>0THENPOKE16562,PEEK(16562)-MO:CLEAR50:X=USR1(0)
1320 PRINT@960,"<ENTER> TO RUN MACHINE CODE . . .";
1330 INPUTA$
1340 CLS:X=USR(0):END
1400 ' ***** END OF MAIN PROGRAM *****
1999 ' INTEGER ASSIGNMENT ROUTINE
2000 GOSUB514:GOSUB518:GOSUB520:V1=PC-65:GOSUB514:IFPC<>213TREN522
2010 GOSUB514:IF(PC=49ANDPN=207)OR(PC=40ANDPN=205)THEN2400
2011 IFPC=246THENGOSUB2017:P=126:GOSUB512:GOTO2027' ASC
2012 IFPC<>192THEN2015ELSEGOSUB2017:V1=V3:C1=VN-2:GOSUB014:P=34:GO
SUB512:P=E1:GOSUB512:P=D1:GOSUB512:P=6:GOSUB512:P=255:GOSUB512:P=1
26:GOSUB512:P=4:GOSUB512:P=35:GOSUB512:P=103:GOSUB512:P=32:GOSUB51
2:P=250:GOSUB512:P=120:GOSUB512
2013 C1=VN-3:GOSUB014:GOSUB902:P=119:GOSUB512:GOSUB916:GOSUB514:RE
TURN' VARPTR OF STRING
2015 IFPC<>245THEN2020ELSEGOSUB2017:P=126:GOSUB512:P=254:GOSUB512:
P=45:GOSUB512:P=32:GOSUB512:P=2:GOSUB512:P=55:GOSUB512:P=35:GOSUB5
12:P=245:GOSUB512
2016 P=205:GOSUB512:P=90:GOSUB512:P=30:GOSUB512:P=241:GOSUB512:P=4
8:GOSUB512:P=7:GOSUB512:P=33:GOSUB512:P=0:GOSUB512:GOSUB512:P=103:
GOSUB512:P=237:GOSUB512:P=02:GOSUB512:GOSUB900:GOSUB900:V1=V3:GOSU
B916:GOSUB514:RETURN' VAL
2017 V3=V1:Q=Q+1:GOSUB514:GOSUB510:IFPN<>36THEN522:ELSEQ=Q+1:V1=PC

```

Listing 1 continued

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-65:MF=VS+V1*(SL+1):C1=MF:GOSUB814:GOSUB982:GOSUB514:RETURN:LOCAT
E STRING
2020 IFPC=216:GOSUB514:GOSUB788:GOSUB978:P=285:GOSUB512:P=61:GOSUB5
12:P=11:GOSUB512:IFPC<>41:THEN522ELSEGOSUB514:GOSUB916:RETURN:INT
2025 IFPC<>22:THEN283ELSEV3=V1:GOSUB514:GOSUB514:GOSUB818:IFC1=-1
THENV1=PC-65:GOSUB518:GOSUB528:GOSUB514:GOSUB914:P=126:GOSUB512ELS
EP=58:GOSUB512:P=EL:GOSUB512:P=D1:GOSUB512:PEEK
2027 P=38:GOSUB512:P=8:GOSUB512:P=111:GOSUB512:V1=V3:GOSUB916:GOSU
B514:RETURN:PEEK
2030 IFPC=19:THENV3=V1:GOSUB688:P=42:GOSUB512:P=33:GOSUB512:P=65:
GOSUB512:V1=V3:GOSUB916:RETURN:POINT
2032 V2=V1:Q=Q-1:GOSUB514:IFPC=286:ANDPN<47:ANDPN<5:GOSUB818:GOSUB98
2:GOTO2848ELSEIFPC=286:THEN1=8:OL=8:GOSUB982:GOTO2848
2035 GOSUB818:IFC1<>-1:GOSUB982ELSEV1=PC-65:GOSUB518:GOSUB528:GOSUB
914:GOSUB514
2040 IFPC=58:ORC=2V1=V2:GOSUB916:RETURN
2045 IFPC=286:ANDPN<47:ANDPN<5:BSG=285ELSESG=PC:GOSUB514
2050 GOSUB2868:IFSG=285:GOSUB988ELSESG=285
2055 GOTO2848
2060 GOSUB818:IFC1<>-1:GOSUB988:RETURNELSEV1=PC-65:GOSUB518:GOSUB52
8:P=237:GOSUB512:P=91:GOSUB512:GOSUB848:GOSUB512:P=P1:GOSUB512:GOS
UB514:RETURN
2099 ' INTEGER VARIABLE TRANSFER ROUTINE
2400 IFPC=49:ANDPN=287:CH=ELSECN=8
2410 Q=Q-1:GOSUB514:MF=VN:GOSUB888:Q=Q+1:GOSUB982:P=285:GOSUB512:P
=13:GOSUB512:P=38:GOSUB512
2420 IFCM=8:P=26:GOSUB512:P=11:GOSUB512:P=19:GOSUB512:P=26:GOSUB51
2:P=183:GOSUB512:GOSUB916:RETURN:TRANSFER BASIC VARIABLE INTO US
R VARIABLE
2430 GOSUB914:P=125:GOSUB512:P=18:GOSUB512:P=19:GOSUB512:P=124:GOS
UB512:P=18:GOSUB512:RETURN:TRANSFER USR VARIABLE INTO BASIC VARI
ABLE
2499 ' PRINT ROUTINE
2500 GOSUB514:IFPC=58:ORC=2P1=13:GOSUB2678:RETURN
2502 IFPC<>64:ANDPC<>96:THEN2688ELSEGOSUB514
2503 ' PRINT 8
2504 IFPC=58:Q=Q-1:GOSUB2588:C1=C1+15368:GOSUB514:GOSUB814:GOSUB982
ELSEV1=PC-65:GOSUB518:GOSUB528:GOSUB514:GOSUB514:GOSUB914:OL=68:EL
=8:GOSUB988:GOSUB984
2508 IFPC<>247:P=34:GOSUB512:P=32:GOSUB512:P=64:GOSUB512:GOTO2688EL
SEGOSUB514:IFPC<>48:THEN522ELSEGOSUB2588:GOSUB918
2510 GOSUB514:IFPC=285:GOSUB514:IFPC<>247:THEN522ELSEP=35:GOSUB512:G
OTO2588
2512 IFPC=59:GOSUB514
2514 IFPC<>58:ANDC<>2:THEN522ELSERETURN
2500 CS=""
2505 GOSUB514:IFPC<>41:ANDPC<>44:THENCS=CS+CRRS(PC):IFPC<>48:ORC<>57:TH
EN522ELSEGOTO2585
2590 C1=VAL(CS):RETURN
2599 ' SINGLE PRECISION EXPRESSION & STRING PRINT ROUTINE
2600 IFPC<>64:ANDPC<>91:ANDPN=36:Q=Q+1:V1=PC-65:C1=VS+V1*(SL+1):GOSUB26
88:GOTO2638
2610 IFPC=34:PC=PEEK(Q):Q=Q+1:MF=VN:PP=1:GOSUB888:PP=8:GOSUB2688:GO
TO2638
2620 Q=Q-1:GOSUB788:GOSUB978:P=285:GOSUB512:P=189:GOSUB512:P=15:GO
SUB512:GOSUB968:' SINGLE PRECISION PRINT
2630 IFPC=44:THEN522
2640 IFPC=59:GOSUB514:IFPC<>58:ANDC<>2:THEN2688ELSERETURN
2650 IFPC=58:ORC=2P1=13:GOSUB2678:RETURN
2660 GOTO522

```

Listing 1 continued

```

2670 P=62:GOSUB512:P=P1:GOSUB512:P=285:GOSUB512:P=58:GOSUB512:P=3:
GOSUB512:RETURN:' SCREEN CONTROL ROUTINE
2680 GOSUB936:GOSUB982:GOSUB968:GOSUB514:IFPC=34:GOSUB514:RETURNELS
E:RETURN:' PRINT STRING
2699 ' INPUT
2700 P=285:GOSUB512:P=179:GOSUB512:P=27:GOSUB512:GOSUB514:IFPN=367
BENGOSUB518:GOSUB988:Q=Q+1:V1=PC-65:MF=VS+V1*(SL+1)-1:C1=MF:GOSUB8
14:GOSUB982:GOTO4787ELSEP=35:GOSUB512:P=285:GOSUB512:P=188:GOSUB51
2:P=14:GOSUB512
2710 IFPN=37:P=285:GOSUB512:P=127:GOSUB512:P=18:GOSUB512:V1=PC-65:G
OSUB848:EL=P1:GOSUB982:P=237:GOSUB512:P=75:GOSUB512:P=33:GOSUB
512:P=65:GOSUB512:P=113:GOSUB512:P=35:GOSUB512:P=112:GOSUB512:GOS
UB514:GOSUB514:IFPC<>58:ANDC<>2:THEN522ELSERETURN
2720 Q=Q-1:CP=1:GOSUB514:GOSUB512:P=175:GOSUB512:P=64:GO
SUB512:P=222:GOSUB512:P=4:GOSUB512:GOSUB922:P=285:GOSUB512:P=284:G
OSUB512:P=18:GOSUB512:GOSUB565:GOSUB972:GOSUB514:IFPC<>58:ANDC<>2:TH
EN522ELSERETURN
2999 ' INTEGER IF - THEN ROUTINE
3000 GOSUB514:IFPN<>37:THEN3188ELSEGOSUB528:V1=PC-65:GOSUB914:GOSUB
988:GOSUB514
3005 IFPC=212:ANDPN=213:ORPC=213:ANDPN=212:W1=1:Q=Q+1:GOTO3835
3010 IFPC=214:ANDPN=213:ORPC=213:ANDPN=214:W1=2:Q=Q+1:GOTO3835
3015 IFPC=212:ANDPN=214:ORPC=214:ANDPN=212:W1=3:Q=Q+1:GOTO3835
3020 IFPC=212:W1=4
3025 IFPC=214:W1=5
3030 IFPC=213:W1=6
3035 GOSUB514:IFPC=58:ORPC=286:GOSUB818:GOSUB982ELSEGOSUB518:GOSUB52
8:V1=PC-65:GOSUB914:GOSUB514
3040 IFPC<>28:ANDPC<>141:THEN522ELSEGOSUB514:IFPC=141:GOSUB514
3045 GOSUB818:IFC1<>8:ORC1<>58:THEN522
3050 P=285:GOSUB512:P=57:GOSUB512:P=18:GOSUB512
3055 GOTO3158
3099 ' SINGLE PRECISION IF - THEN ROUTINE
3100 Q=Q-1:GOSUB788:GOSUB934
3105 IFPC=212:ANDPN=213:ORPC=213:ANDPN=212:W1=1:Q=Q+1:GOTO3135
3110 IFPC=214:ANDPN=213:ORPC=213:ANDPN=214:W1=2:Q=Q+1:GOTO3135
3115 IFPC=212:ANDPN=214:ORPC=214:ANDPN=212:W1=3:Q=Q+1:GOTO3135
3120 IFPC=212:W1=4
3125 IFPC=214:W1=5
3130 IFPC=213:W1=6
3135 GOSUB788:GOSUB936:GOSUB950
3140 IFPC<>28:ANDPC<>141:THEN522ELSEGOSUB514:IFPC=141:GOSUB514
3145 GOSUB818:IFC1<>8:ORC1<>58:THEN522
3150 D=01:E=EL:ONW1GOTO3155,3160,3165,3170,3175,3180
3155 GOSUB3185:GOSUB3288:RETURN
3160 GOSUB3185:GOSUB3198:RETURN
3165 GOSUB3195:RETURN
3170 P=48:GOSUB512:P=3:GOSUB512:GOSUB3288:RETURN
3175 P=48:GOSUB512:P=3:GOSUB512:GOSUB3198:RETURN
3180 GOSUB3185:RETURN
3185 P=282:GOSUB3388:RETURN
3190 P=242:GOSUB3388:RETURN
3195 P=194:GOSUB3388:RETURN
3200 P=258:GOSUB3388:RETURN
3205 P=195:GOSUB3388:RETURN
3300 GOSUB512:K=K+1:A(K)=M:P=8:GOSUB512:P=0:GOSUB512:RETURN
3310 K1=K+1:K1(K)=H:RETURN
3499 ' GOTO ROUTINE
3500 GOSUB514:GOSUB818:IFC1<>8:ORC1<>58:THEN522ELSED=D1:E=E1:GOSUB328
8:RETURN
3699 ' GOSUB ROUTINE
3700 GOSUB514:GOSUB818:IFC1<>8:ORC1<>58:THEN522ELSESED=OL:E=E1:P=285:GO

```

Listing 1 continued

```

SUB3300: RETURN
3799 ' RETURN
3800 GOSUB924: P=233: GOSUB512: RETURN
3999 ' SINGLE PRECISION VARIABLE TRANSFER ROUTINE
4000 IFPC=49ANDPN=207THENC=1ELSECM=0
4010 GOSUB514: GOSUB514: IF=VN: GOSUB900: GOSUB514: GOSUB902: P=205: GOSUB
P512: P=13: GOSUB512: P=38: GOSUB512
4020 IFCM=0GOSUB900: GOSUB933: GOSUB565: GOSUB972: RETURN
4030 GOSUB930: GOSUB565: GOSUB932: GOSUB924: GOSUB972: RETURN
4499 ' STRING ASSIGNMENT ROUTINE
4500 GOSUB514: V1=PC-65: MF=V5+V1*(SL+1)
4510 GOSUB514: IFPC<>36THEN522
4520 GOSUB514: IFPC<>213THEN522
4530 GOSUB514: IFPC=247THEN4608ELSEIFPC>64ANDPC<91THEN4700ELSEIFPC<
>34THEN522
4540 PC=PEEK(Q): Q=Q+1: P=1: GOSUB900: FP=0
4550 GOSUB514: IFPC=34GOSUB514
4560 IFPC=205ANDPN=247THENGOSUB908: GOTO4710
4570 IFPC=205ANDPN=34THENPC=PEEK(Q+1): Q=Q+2: FP=1: MN=1: GOSUB901: FP=
8: GOTO4508ELSEIFPC=205THENGOSUB514: IFPC>64ANDPC<91ANDPN=36THENQ=Q+
1: GOSUB908: P=43: GOSUB512: GOTO4705ELSE522
4580 RETURN
4599 ' STRING ASSIGNMENT USING CHR$
4600 C1=MF: GOSUB836: GOSUB902
4610 GOSUB514: IFPC<>40THEN522ELSECS$=""
4615 GOSUB514: IFPC>64ANDPC<91THENV1=PC-65: GOSUB520: GOSUB514: IFPC<
41THEN522ELSE522: GOSUB512: GOSUB840: GOSUB512: P=P1: GOSUB512: P=119: G
OSUB512: GOTO4660
4620 IF(PC=40RORPC>57)ANDPC<>41THEN522
4630 IFPC<>41THENC$=C$+CHR$(PC): GOSUB514: GOTO4620
4640 C1=VAL(C$)
4650 GOSUB910
4660 GOSUB514: IFPC=205GOSUB514: IFPC<>247THENP=35: GOSUB512: Q=Q-2: G
OSUB514: GOTO4720ELSEP=35: GOSUB512: GOTO4610
4670 IFPC=58ORC=2THENP=35: GOSUB512: C1=0: GOSUB910: RETURNELSEGOTO522
4699 ' STRING ASSIGNMENT USING PREVIOUSLY DEFINED VARIABLE
4700 IFPN<>36THEN522ELSEQ=Q+1: C1=MF-1: GOSUB814: GOSUB902
4705 V1=PC-65: MX=V5+V1*(SL+1)-1: C1=MX: GOSUB836: GOSUB908
4707 P=35: GOSUB512: P=19: GOSUB512: P=26: GOSUB512: P=119: GOSUB512: P=18
3: GOSUB512: P=32: GOSUB512: P=249: GOSUB512: GOSUB514
4710 IFPC=205ANDPN=247THENOQ=Q-1: P=43: GOSUB512: GOTO4660
4720 IFPC=205ANDPN=34THENGOSUB908: GOTO4570ELSEIFPC=205THENGOSUB514
: GOSUB518: IFPN<>36THEN522ELSEQ=Q+1: P=43: GOSUB512: GOTO4705
4730 RETURN
4999 ' FOR ROUTINE
5000 C1=M*7: GOSUB936: GOSUB514: GOSUB510: GOSUB520: V1=PC-65: GOSUB840:
GOSUB514: D(V1)=D1: E(V1)=E1: IFPC<>213THEN522
5010 GOSUB514: IFPC<65ORPC=206GOSUB818: J1=0: ID=D1: IF=E1: ELSEJ1=1: V2
=PC-65: GOSUB520: C1=V1+V2*2: GOSUB936: ID=D1: IE=E1: GOSUB514
5020 IFPC<>109THEN522
5030 GOSUB514: IFPC<65ORPC=206GOSUB910: J2=0: FD=D1: FE=E1: ELSEJ2=1: V3=
PC-65: GOSUB520: C1=V1+V3*2: GOSUB936: FD=D1: FE=E1: Q=Q+1
5040 IFJ2=0THENP=33ELSEP=42
5050 GOSUB512: P=FE: GOSUB512: P=FD: GOSUB512: GOSUB926
5060 IFJ1=0THENEL=IE: D1=ID: GOSUB902
5070 IFJ1=1THENP=42: GOSUB512: P=IE: GOSUB512: P=ID: GOSUB512
5080 GOSUB916: IFPEEK(Q-1)<>59ANDPEEK(Q-1)<>0THEN522ELSERETURN
5499 ' NEXT ROUTINE
5500 GOSUB514: GOSUB510: GOSUB520: V1=PC-65: GOSUB914: GOSUB928: GOSUB93
0: GOSUB926: GOSUB928: GOSUB924: P=35: GOSUB512: P=194: GOSUB512: P=E(V1):
GOSUB512: P=D(V1): GOSUB3310: GOSUB520: GOSUB924: GOSUB514: RETURN

```

```

5999 ' POINT, SET & RESET
6000 IFPC=130THENW=1ELSEIFPC=131THENW=120ELSEIFPC=190THENW=0
6010 NA=8
6020 GOSUB514: IFPC<>40THEN522ELSEGOSUB514: GOSUB910: IFC1=-1GOSUB510
: GOSUB520: V1=PC-65: GOSUB908: D2=P1: E2=P: C2=1ELSEE2=E1: C2=0: IFPC<>44
THEN522
6030 IFC2=1GOSUB514: IFPC<>44THEN522
6040 GOSUB514: GOSUB910: IFC1=-1GOSUB510: GOSUB520: V1=PC-65: GOSUB908:
D3=P1: E3=P: C3=1ELSEE3=E1: C3=0: IFPC<>41THEN522
6050 IFC3=1GOSUB514: IFPC<>41THEN522
6060 GOSUB514: IFPC<>50ANDC<>2THEN522
6070 C1=NA+1+8+C2+C3: GOSUB936: GOSUB902: MN=N-1: GOSUB3310: MN=N+1: GOSUB9
26: E1=126: D1=7: GOSUB902: P=62: GOSUB512: P=W: GOSUB512: P=245: GOSUB512
: GOSUB512: P=E2: GOSUB512: P=D2: GOSUB512: P=02: GOSUB512: ELSEP=62:
GOSUB512: P=E2: GOSUB512
6080 P=245: GOSUB512
6100 IFC3=1THENP=50: GOSUB512: P=E3: GOSUB512: P=D3: GOSUB512ELSEP=62: G
OSUB512: P=E3: GOSUB512
6110 E1=00: D1=1: GOSUB910: RETURN
6499 ' POKE ROUTINE
6500 GOSUB514: GOSUB910: IFC1=-1THENGOSUB510: GOSUB520: V1=PC-65: GOSUB
914: GOSUB514ELSEGOSUB902
6510 IFPC<>44THEN522
6520 GOSUB514: GOSUB910: IFC1=-1GOSUB510: GOSUB520: V1=PC-65: GOSUB840:
E1=P: D1=P1: P=58: GOSUB512: P=E1: GOSUB512: P=D1: GOSUB512: GOSUB514ELSEP
=62: GOSUB512: P=E1: GOSUB512
6530 IFPC<>50ANDC<>2THEN522
6540 P=119: GOSUB512: RETURN
6999 ' ROUTINE FOR CODE TO STORE 2-D ARRAY ADDRESSES
7000 GOSUB524: PRINT*CODE TO STORE 2-D ARRAY ADDRESSES*: PRINT: C1=VD
: GOSUB836: GOSUB902
7010 C1=VD+4*NT*DT*OT: GOSUB836: P=221: GOSUB512: GOSUB902: C1=4*OT: GOS
UB814: GOSUB900
7020 C1=NT*OT: GOSUB814: P=1: GOSUB512: P=E1: GOSUB512: P=D1: GOSUB512
7030 P=221: GOSUB512: P=117: GOSUB512: P=0: GOSUB512
7040 P=221: GOSUB512: P=35: GOSUB512
7050 P=221: GOSUB512: P=116: GOSUB512: P=0: GOSUB512
7060 P=221: GOSUB512: P=35: GOSUB512: GOSUB904: P=13: GOSUB512
7070 C1=M-12: GOSUB836: P=194: GOSUB512: P=E1: GOSUB512: P=D1: GOSUB3310:
GOSUB512
7080 P=5: GOSUB512: P=14: GOSUB512: P=255: GOSUB512: C1=M-10: GOSUB836: P=
242: GOSUB512: P=E1: GOSUB512: P=D1: GOSUB3310: GOSUB512
7090 PRINT*056, "MAIN CODE BEGINS": RETURN
7100 GOSUB514: Q1=Q: IFPC=50THEN7104ELSEIFPC<>2THENGOTO7100' CLEAR
7102 Q=Q+4
7104 GOSUB514: RETURN
7110 IS=1: DO=0: DT=0: ND=0: NT=0: NS=2' DIM
7112 CS="" : GOSUB514: Q1=Q: IFPC=50THENQ=Q-4: Q1=Q: RETURNELSEIFC=2THEN
RETURNELSEIFPC=4THEN7112
7114 V=1: IFPC<65ORPC>90THENGOTO7126ELSEV3=PC-64
7116 IFPN=36THENQ=Q+1: V=2: ELSEIFPN>47ANDPN<50THENIS=PN-47: Q=Q+1: GO
TO7112
7118 GOSUB514: IFPC<>40THENGOTO7126
7120 GOSUB514: IFPC=41THEN7130ELSEIFPC=44THENOT=VAL(C$): C$="" : GOTO7
122ELSEIFPC=65ANDPC>90THENGOTO7126ELSECS=C$+CHR$(PC): GOTO7120
7122 GOSUB514: IFPC=41THEN7124ELSEIFPC=<65ANDPC>90THENGOTO7126ELSEC
$=C$+CHR$(PC): GOTO7122
7124 NT=V3: IFDT=VAL(C$)THENGOTO7112
7126 PRINT*ERROR IN DIM STATEMENT*: END
7130 IFV=1THENNO=V3: DO=VAL(C$)
7132 IFV=2THENNS=V3: EL=VAL(C$)
7134 GOTO7112
7135 GOSUB514: IFPC<>50ANDC<>2THEN7135

```

Listing 1 continued

```

7136 C1=VN:GOSUB814:P=175:GOSUB512:GOSUB982:P=119:GOSUB512:C1=VN+1
:GOSUB814:GOSUB980:C1=MR*16384-VN-1:GOSUB814:P=1:GOSUB512:P=EL:GO
SUB512:P=D1:GOSUB512:P=237:GOSUB512:P=176:GOSUB512:RETURN:CLR
7200 : ***** END OF THE COMPILER *****
10000 : ***** BASIC PORTION OF THE ARRAY SORTING PROGRAM *****
10010 DIM A(400):INPUT "ARRAY DIMENSION",N
10020 FOR I=1 TO N:A(1)=200*INT(RND(1)):NEXT I
10030 FOR I=1 TO N:PRINT A(I):NEXT I
10040 PRINT "PRES A KEY TO RUN"
10050 A$=INKEY$:IF A$="" THEN 10050
10060 X=USR(8)
10070 PRINT:PRINT "DONE":PRINT:PRINT "PRES A KEY TO PRINT THE SOH
TED ARRAY"
10080 A$=INKEY$:IF A$="" THEN 10080
10090 FOR I=1 TO N:PRINT A(I):NEXT I

```

End

Program Listing 2. Demonstration program using string input, ASC, Clear, and Dimension statements.

```

100 CLEAR50:DIMAS(40)
20 CLS
30 PRINT:PRINT "Answer Yes, No, or Quit";:INPUTAS:A$=ASC(A$)
40 'THE ASCII VALUE FOR Q IS 81. q IS 113
50 IFA$=81THEN120ELSEIFA$=113THEN120
60 'THE ASCII VALUE FOR N IS 78, n IS 110
70 IFA$=78THEN100ELSEIFA$=110THEN100
80 'THE ASCII VALUE FOR Y IS 89, y IS 121
90 IFA$=89THEN110ELSEIFA$=121THEN110ELSEGOTO30
100 PRINT"The answer was no.":GOTO30
110 PRINT"The answer was yes.":GOTO30
120 PRINT:PRINT"You asked to quit."
130 PRINT:PRINT"You are now returned to BASIC."
500 ENO

```

End

Program Listing 3. Using substitute programming techniques for compilation purposes.

```

10 CLEAR50:DIMBS(60)
20 CLS
30 PRINT:PRINT"EXAMPLES OF VARPTR(AS), LEN(AS), AND LEFT$(AS,5)."
40 PRINT:PRINT"USING SUBSTITUTE PROGRAM FOR COMPILATION PURPOSES":PRINT
50 PRINT:PRINT"ENTER A TEN CHARACTER STRING:INPUTAS
60 BS=AS:AS=VARPTR(BS):PRINT"VARPTR LOCATION IS ";AS:BS=PEEK(AS)
70 IFBS<=10THEN80ELSEPRINT"STRING IS GREATER THAN TEN CHARACTERS":
GOTO50
80 IFBS=10THEN90ELSEPRINT"STRING IS LESS THAN TEN CHARACTERS":GOTO
90
90 BS=AS+1:BS=PEEK(BS):CS=AS+2:CS=PEEK(CS)
100 BS=CS+256+BS:IFBS<32768THEN110ELSEBS=B-65536

```

End

End

Program Listing 4. Basic Pong game.

```

110 BS=INT(B):PRINT"STRING LOCATION IS ";BS
120 'THE NEXT LINE WILL NOT GIVE THE SAME RESULTS IN BASIC
130 BS=BS+5:POKEBS,0
140 PRINT"THE ORIGINAL STRING IS . . . ";AS
150 PRINT"THE EQUIVALENT OF BS=LEFT$(AS,5) IS . . . ";BS
500 END

5 DIMAS(40),A1
10 Q0=20:A0=25
15 L0=25:O0=20
20 CLS:PRINT"Row fast (1 to 1000)?:INPUT D0:CLS:N0=0:S0=0:PRINT
#132,N0:PRINT#186,S0
25 FORVA=9TO39:SET(8,Y0):SET(127,Y0):NEXTY0
30 C0=1
35 PRINT#158,"Pong";
40 X0=1
45 FORI0=20TO25:SET(7,I0):SET(120,I0):NEXTI0
50 FORX0=1TO126:SET(X0,9):SET(X0,39):NEXTX0
55 Y0=10:Z0=INT(100*INT(0)):K0=Z0+10
60 SET(X0,Y0)
65 FORI0=1TOO0:NEXTI0
70 RESET(X0,Y0)
75 V0=PEEK(14337):U0=PEEK(14330):W0=PEEK(14340):Z0=V0+U0+W0
80 IZ0=8THEN105
85 IFU0<>120THEN90:ELSEGOSUB205
90 IFW0<>16THEN95:ELSEGOSUB210
95 IFV0<>2THEN100:ELSEGOSUB215
100 IFV0<>2THEN105:ELSEGOSUB220
105 Z0=PEEK(14400):IFZ0=4THEN500
110 X0=X0+C0
115 Y0=Y0-K0
120 IFY0>=39THEN125ELSEIFY0>9THEN140
125 IFX0>122THEN185
130 IFX0<6THEN180
135 B0=POINT(X0,Y0):IFB0<8THEN160
140 IFX0>122THEN185
145 IFX0<5THEN180
150 B0=POINT(X0,Y0):IFB0<8THEN170
155 GOTO60
160 K0=-K0
165 GOTO115
170 C0=-C0
175 GOTO110
180 S0=S0+1:PRINT#186,S0:IFS0>15THEN190:ELSEGOTO55
185 N0=N0+1:PRINT#132,N0:IFN0>15THEN190:ELSEGOTO55
190 PRINT#982,"Play Again? (Y/N)";
195 Z0=PEEK(14344):IFZ0=2THEN20
200 Z0=PEEK(14330):IFZ0=64THEN500ELSEGOTO195
205 RESET(120,I0):O0=O0-1:L0=L0-1:SET(120,O0):RETURN
210 RESET(120,O0):O0=O0+1:L0=L0+1:SET(120,L0):RETURN
215 RESET(7,A0):O0=O0-1:A0=A0-1:SET(7,O0):RETURN
220 RESET(7,O0):O0=O0+1:A0=A0+1:SET(7,A0):RETURN
500 END

```

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"Twas brillig, and
the slithy toves"

"Twas brillig, and the
slithy toves"

"Twas brillig, and
the slithy toves"

"Twas brillig, and/the slithy toves"

"Twas brillig, and
the slithy toves"

"Twas brillig, and
the slithy toves"

"Twas brillig,
and the slithy toves"

"Twas brillig,
and/the slithy toves"



M



FrB

MODEL 4 SCRIPSIT THE WRITE WAY

by Clifford Knight

What Model 4 Scripsit should have been—ScripAid reassigns Scripsit's command keys, allows text preview on-screen, and provides a potpourri of type fonts.

Like most Model 4 owners, I looked forward to Model 4 Scripsit with great anticipation. But I was disappointed when I found that Model 4 Scripsit was nothing more than a reassembled version of the Model III program. Tandy even included the old keycap "pasties" for Scripsit's command keys. I decided to write a complete enhancement package called ScripAid that includes all the features I want in Model 4 Scripsit.

ScripAid reassigns Scripsit's command keys to their mnemonic counterparts (see Table 1), lets you preview text on your screen before printing it out, and supports compressed, double-width, emphasized, italic, underline, double-strike, and super- or subscript characters (see the Figure).

ScripAid consists of five programs. Program Listings 1 and 2 provide the actual Scripsit enhancements. Program Listing 3 installs the enhancement programs with a

JCL file. Program Listing 4 lets you develop a customized printer driver for ScripAid. Program Listing 5 gives you a help file template.

The Programs

Program Listing 1, Enhance/SRC, is the source code that implements ScripAid's enhanced commands. It also loads a printer driver and, if applicable, resets the Model 4's extra memory banks and changes Scripsit's start-of-text buffer pointers to allow more memory space for ScripAid routines.

Program Listing 2, Rekey/SRC, contains patches to the command codes that change the more confusing Scripsit commands to easily remembered keys (yes, you can throw away the pasties). It also includes patches that alter the default left- and right-margin settings and the video line width. You can alter these fur-

```

>TM=5
>C=Y
\3*** ScripAid \4printer control demonstration\5 ***
>C=N
\#

This is an example of the power of \6\3ScripAid\#\&.

\3You can set the emphasized mode at the start of your text, and then add \6DOUB
LE-STRIKE\& for added visual impact.

\#You can switch to \2DOUBLE-WIDTH\& and back.

Or underline \5here\% and \5there\% as you wish.

Even \1compressed\! and \1super\%/ \7sub\% scripts may be used.

\3Y\#\2D\ "\3\6U\%\# can \4do it all\5 \3 with \6\5ScripAid\%\&.

```

*** ScripAid printer control demonstration ***

```

This is an example of the power of ScripAid.

You can set the emphasized mode at the start of your text, and
then add DOUBLE-STRIKE for added visual impact.

You can switch to DOUBLE-WIDTH and back.

Or underline here and there as you wish.

Even compressed and super/sub scripts may be used.

YOU can do it all with ScripAid.

```

Figure. Text with ScripAid commands embedded (top) and as it appears when you print it out (bottom).

ther if you want to boot up the program with other values set. In addition, I modified all prompts and error messages to provide upper- and lowercase characters.

Program Listing 3, the JCL file, installs the Scripsit overlays assembled from the source code so you can use ScripAid.

Program Listing 4, Driver/BAS, lets you customize a printer driver file. It prompts you to assign printer control codes for each ScripAid print command. For instance, \1 is the ScripAid command that prints a compressed character. When Driver prompts you to input the code that makes your printer print a compressed character, you should find the right code in your print-

er manual and type it in.

Every printer requires a different driver as there are no standard printer control codes. Table 2 (p. 65) shows the codes I used with my Epson MX-80 printer. Table 3 (p. 65) defines the print commands you embed in your text.

Program Listing 5, Helper, gives you the information you need to develop a help file.

Creating ScripAid

Type in and assemble Program Listings 1 and 2, and save them as Enhance/OVL and Rekey/OVL.

Now you're ready to build the JCL file in Program Listing 3. Use the DOS Build command or Scripsit (saved in ASCII format) and write it to the same disk that contains the overlay files. (I recommend that you use a system disk in drive I as the target for all the ScripAid files. This way, you'll end up with the entire ScripAid program on a single disk.)

If you're a single-drive user, write all files to drive zero, then delete all references to drive I from the JCL file.

To create ScripAid/CMD, first insert a back-up copy (for added security) of the original Scripsit program in drive zero. The system disk containing both the

ScripAid overlay files and the JCL file should be in drive I. Now type in DO SCRIPAIID:1. This executes the DOS commands of the JCL file, transforming your version of Scripsit to the upgraded ScripAid. Single-drive users should copy their Scripsit to a system disk and assemble the two overlay files on the same disk. Then execute the modified JCL (mentioned above) and you're ready to use ScripAid.

Although you don't have to use ScripAid's new print codes, you do have to include at least one printer driver so the program can load and execute. You should name this driver Default/PDC and put it on the same disk as ScripAid. If you have access to more than one printer, you can develop driver files for each printer. When calling ScripAid, specify the driver you want on the TRSDOS command line by typing in SCRIPAIID followed by the driver file name.

You can create a driver file for your printer with the help of Program Listing 4. Here, the first screen prompts you to enter either a file name for the file you want to create, or hit control-Q to quit. If you hit the enter key, the program uses the file name Default.

Once you specify the file name,

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ScripAid creates two files, one with the extension /PDC for the driver, and one with the extension /HLP for the driver help screen. The next screen displays the file name used, the current code assignments, and the shifted complements for keys 1-9. A prompt at the bottom of the screen gives you the following options: to enter the key you want programmed, to save the current assignments (S), or to abort and cancel all changes (A).

If you hit any of the control-code keys, you'll be prompted to enter up to five decimal numbers that, in turn, form the format control string assigned to the previously selected key. After entering the five values you'll see that they've been assigned to the selected key. If your printer's control sequence doesn't require 5 bytes (values) then hit the enter key in response to the next CODE # prompt to terminate data entry.

Then ScripAid asks you to enter a short description (up to 70 characters) of this control string's function. The program displays this information when you request printer help from ScripAid. When you've finished programming, type in S to save the files. ScripAid then returns you to the first menu) from which you can opt to create another driver or quit ScripAid.

If you want to include a help file with ScripAid, Program Listing 5 will help you build your own. Such a file, however, takes up more than 20K of disk space, which is why I find a quick-reference card more convenient.

The Source Code

Program Listing 1, ScripAid's source code, is fully commented, but it's important that you understand the main logic flow. First, the program defines the supervisor calls (SVCs) and then assigns the hook vectors to and from Scripsit. Lines 880-1150 alter the sign-

Reassigned Scripsit Commands

General Commands

Clear-B	Enter text block
Clear-I	Insert text
Clear-G	Start paragraph
Clear-L	End line
Clear-N	Force new page
Clear-Z	Enter window mode

Delete Commands

Clear-G	Delete paragraph
Clear-L	Delete line
Clear-S	Delete spaces to left of cursor
Clear-W	Delete word

Insert Commands

Clear-B	Insert block
Clear-L	Insert line

Exchange Commands

Clear-B	Exchange block
Clear-G	Exchange paragraph
Clear-W	Exchange words

Enhanced Scripsit Commands

Disk-related

Break-Q	Query disk directory
Break-K	Kill named file

Printer related

Break-P,Cnn	Send CHR\$(nn) to printer
Break-P,T	Send top-of-form character to printer
Break-P,V	Preview text (use 0-9 to control speed, @ to pause, shift/clear to abort)

Help Screens

Break-HK	Keyboard help file
Break-HP	Printer help file

Bank Switching

Break-Bnn	Make memory bank nn active buffer
-----------	-----------------------------------

Table 1. ScripAid commands.

ScripAid Commands	Command Descriptions
\1	Set compressed-character mode
\!	Reset compressed-character mode
\2	Set double-width mode
\"	Reset double-width mode
\3	Set emphasized mode (except in compressed, sub-, or superscript modes)
\#	Reset emphasized mode
\4	Set italics mode
\5	Reset italics mode
\5	Set underline mode
\%	Reset underline mode
\6	Set double-strike mode
\&	Reset underline, sub-, and superscript modes
\7	Set subscript mode
\'	Set superscript mode
\8	
\(
\9	
\)	

Table 2. Suggested control key assignments for the Epson MX-80 Type III printer.

ScripAid Commands	Printer Codes
\1	15
\!	18
\2	27 87 1
\"	27 87 0
\3	27 69
\#	27 70
\4	27 52
\5	27 53
\5	27 45 1
\%	27 45 0
\6	27 71
\&	27 72 27 84
\7	27 83 1
\'	27 83 0
\8	
\(
\9	
\)	

Table 3. Definitions of the print commands.

```

00100 ;***** ENHANCE *****
00110 ;
00120 ; An enhancement package for Model 4 SCRIPSIT adding:
00130 ; 1> Directories from command line
00140 ; 2> Kill files from command line
00150 ; 3> Embedded printer control codes
00160 ; 4> Printer codes from command line
00170 ; 5> Formatted output to video monitor
00180 ; 6> Send TOP character to printer
00190 ; 7> Bank switching for 3 text buffers
00200 ; 8> On-line Help available
00210 ;
00220 ; Install via:
00230 ;
00240 ; 1. memory (clear)
00250 ; 2. load scripsit/cmd
00260 ; 3. load rekey/ovl
00270 ; 4. load enhance/ovl
00280 ; 5. dump scripsit/cmd (s=x'3000',c=x'6970',t=x'6010')
00290 ;
00300 ;*****
00310 ;
00320 ;
00330 ; Supervisor Call Equates.....
00340 DSPLY EQU 0AH ;DISPLAY A MESSAGE LINE
00350 LOGOT EQU 0CH ;DISPLAY & LOG A MESSAGE
00360 PAUSE EQU 10H ;DELAY FOR "BC" COUNTS
00370 CHNIO EQU 14H ;PASS TO NEXT MODULE IN DEV CHAIN
00380 ERROR EQU 1AH ;POST AN ERROR MESSAGE
00390 HIGH EQU 64H ;GET/PUT HIGHS/LOWS
00400 FLAGS EQU 65H ;POINT IY TO SYSTEM FLAGS
00410 FSPEC EQU 4EH ;VERIFY FILESPEC
00420 BANK EQU 66H ;MEMORY BANK SVC
00430 FEXT EQU 4FH ;ADD FILESPEC IF NEEDED
00440 OPEN EQU 3BH ;OPEN A FILE
00450 GET EQU 03H ;GET A BYTE FROM FCB OR DCB
00460 CLOSE EQU 3CH ;CLOSE A FILE
00470 CMNDR EQU 19H ;DO CMD & RET
00480 DECHEX EQU 60H ;ASCII -> BIN IN BC
00490 PRT EQU 06H ;CHAR TO PRINTER
00500 KEY EQU 01H ;WAIT F/ KEY
00510 DSP EQU 02H ;CHAR TO VIDEO
00520 KEYIN EQU 09H ;GET A LINE (*KI)
00530 DDIR EQU 22H ;DSP DIR OF DRIVE
00540 REMOV EQU 39H ;KILL A FILE
00550 EXIT EQU 16H ;RETURN TO DOS
00560 KBD EQU 00H ;WAIT FOR KEY
00570 HEXDEC EQU 61H ;CONVERT BIN-> ASCII
00580 VDCTL EQU 0FH ;VIDEO CONTROL SVC
00590 POSN EQU 42H ;POSITION TO RECORD
00600 READ EQU 43H ;READ A RECORD (DISK)
00610 ;
00620 ;
00630 ; Scripsit Address Equates.....
00640 ;
00650 PRCALL EQU 46C9H ;LOCATION OF @PRT SVC CALL
00660 PRTCHK EQU 4AE1H ;GET *PR STATUS ROUTINE
00670 SCRPIN EQU 5416H ;NORMAL RE-ENTRY POINT
00680 ERRIN EQU 5401H ;*INVALID COMMAND* ENTRY
00690 PREND EQU 54EDH ;HOOK F/ END OF PRINT ROUT
00700 SCRIPS EQU 3900H ;ENTRY TO SCRIPSIT
00710 SCRKIT EQU 383DH ;EXIT CODE
00720 DOUT EQU 5554H ;FORMATTED OUTPUT CALL
00730 KSCAN EQU 47B6H ;KSCAN IN SCRIPSIT
00740 OLDBUF EQU 622BH ;OLD TEXT BUFFER START
00750 CKPRPM EQU 4A9CH ;CK PRINT PARMS
00760 PRPMCK EQU 4AF1H ;SCRIPSIT PRINT PARMCK
00770 BRKCK EQU 40EEH ;SCRIPSIT <BRK> PARMCK
00780 BRKTAB EQU 4F6DH ;<BRK> PARM TABLE
00790 RETBRK EQU 40F1H ;RET TO <BRK> ROUT
00800 SCRPF EQU 5F5AH ;SCRIPSIT INT DISK I/O
00810 PRRETN EQU 4BA5H ;RET AFTER *PR OUT
00820 PRCLN EQU 54FCH ;CLEAN UP AFTER *PR
00830 RETVEC EQU 5EB2H ;RETURN VECTOR
00840 WRTVID EQU 4811H ;REWRITE VIDEO IMAGE
00850 ;
00860 ;
00870 ; *** Patch Sign-on Banner ***
00880 ORG 3EFBH
00890 DEFB 70 ;LENGTH OF MESSAGE
00900 DEFM ' * ScripAid * - Model 4 Version 3.1 - (c) 1984 by Paladin
Software - C. Knight'
00910 *LIST OFF
00920 DEFM ' * ScripAid * - Model 4 Version 3.1 - (c) 1984 by Paladin
Software - C. Knight'
00930 *LIST ON
00940 ;
00950 ;
00960 ; *** Patch to eliminate reset of <BREAK> vector ***
00970 ;
00980 ORG 3906H
00990 DEFW 0000H
01000 DEFW 0000H
01010 DEFW 0000H
01020 ;
01030 ;
01040 ; *** Set jumps to extension code ***
01050 ORG PRCALL
01060 CALL PRTOUT
01070 ;
01080 ORG CKPRPM
01090 CALL CKPARM

```

Listing 1 continued



on banner, eliminate the code to rreset the break vector (which creates problems with the spooler), and arranges jumps from Scripsit to ScripAid.

The initialization routine, assembled at memory address 6810 hexadecimal (hex), loads the selected or default printer driver and resets buffer pointers in Scripsit, making room for ScripAid. As the routine loads the driver codes, it saves the file name with the extension /HLP for later use as a printer Help file. The routine also verifies and initializes the optional memory buffers, if available.

The code for ScripAid actually starts at line 3050 of Program Listing 1. The PALBRK routine intercepts the break/special-command call and checks for valid ScripAid commands, such as Query, Kill, Bank, and Help. You call these by entering the first letter of each command, followed by any needed parameters.

The CKPARM routine in line 6840 of the source code parses the commands added to the Scripsit Print routine. Then ScripAid scans for Scripsit's invisible and pause commands. A reset carry flag (NC) indicates that Scripsit has located a valid parameter. Under these circumstances, ScripAid relinquishes control to the Scripsit parameter. If the Scripsit parameters aren't found, ScripAid tests for these valid ScripAid commands: video (V), top-of-form (T), and control-code output (C).

ScripAid outputs formatted text to the video by altering the output SVC number from 6 (@PRT) to 2 (@DSP), which reroutes each character to the monitor instead of to the printer port. Before output begins, however, ScripAid links to the Scripsit routine that scans for the shift-clear (abort output) key sequence. This link calls a ScripAid routine to scan for the @ key (which pauses the output) or one of the number

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```

01100 ;
01110 ORG BRKCK
01120 JP PALBRK
01130 ;
01140 ORG SCRKIT
01150 JP EXIT1
01160 ;
01170 ;
01180 ;
01190 ;
01200 *** SCRIPSIT Extension Code ***
01210 ;
01220 ORG 6010H
01230 ;
01240 ENTRY LD (OLDSP),SP ;SAVE STACK POINTER
01250 CALL INITF ;LOAD DRIVER FILE
01260 CALL BNKONE ;SET PTRS F/ BANK1
01270 CALL CLRBNK ;RESET BANKS 1&2
01280 JP SCRIPS ;GOTO SCRIPSIT
01290 ;
01300 ;
01310 ;
01320 ;
01330 INITF LD A,(HL) ;GET NXT CMD CHAR
01340 CALL EOLNCK ;END OF LINE ?
01350 JR NZ,MOVFSF ;NZ= FIL SPEC
01360 LD HL,DEFNAM ;HL-> "DEFAULT/PDC"
01370 MOVFSF LD DE,FCB ;DE-> FCB
01380 LD A,FSPEC ;SVC
01390 RST 28H
01400 JR Z,FSPOK ;Z= FILESPEC OK
01410 LD HL,BADFIL ;HL-> "BAD FILE" MSG
01420 JP LOGERR ;GOTO LOG ERR & RET
01430 ;
01440 FSPOK LD HL,PDCTXT ;HL-> DEFAULT EXTENSIC
01450 LD A,PEXT ;SVC
01460 RST 28H ;ADD EXTENSION
01470 PUSH DE ;SAVE FCB POINTER
01480 CALL SAVFSF ;FSPEC-> HOLD
01490 LD HL,BANNER ;HL-> BANNER MESSAGE
01500 CALL DSPMSG ;OUTPUT SAME
01510 POP HL
01520 PUSH HL ;HL-> FILESPEC
01530 CALL DSPMSG
01540 LD C,0DH ;C/R
01550 LD A,DSP
01560 RST 28H
01570 POP DE ;DE-> FCB
01580 ;
01590 EXTN LD HL,SCRPF ;HL-> DISK I/O BUFFER
01600 LD B,90 ;LRL=90
01610 LD A,OPEN ;SVC
01620 RST 28H
01630 JP NZ,ERR
01640 LD HL,CTLTAB ;HL-> COMMAND TABLE
01650 ;
01660 RDLOOP LD B,90 ;90 BYTES MAX
01670 LD DE,FCB ;DE-> FCB
01680 LD A,GET ;SVC
01690 RST 28H
01700 JR NZ,EOP ;ERROR COULD BE EOP
01710 LD (HL),A ;STORE IN CMD TABLE
01720 INC HL ;ELSE BUMP PTR
01730 DJNZ RDLOOP ;LOOP 'TIL EOP
01740 ;
01750 EOP CP 1CH ;ERROR = EOP ?
01760 PUSH AF ;SAVE ERROR STATUS
01770 LD A,CLOSE ;SVC
01780 RST 28H
01790 JR NZ,ERR
01800 POP AF ;GET ORIGINAL ERR
01810 JR NZ,ERR ;ELSE RETURN
01820 RET
01830 ;
01840 ;
01850 SAVFSF LD HL,PHLPFS ;HL-> HOLDING AREA
01860 SAVFSF LD A,(DE) ;GET A CHAR
01870 INC DE
01880 LD (HL),A ;SAVE IT
01890 INC HL
01900 CP '/' ;EXT YET?
01910 JR NZ,SAVFSF
01920 LD (HL),'H'
01930 INC HL
01940 LD (HL),'L'
01950 INC HL
01960 LD (HL),'P'
01970 INC HL
01980 LD (HL),0DH ;"HLP" AS EXTENSION
01990 RET ;DONE
02000 ;
02010 ;
02020 ;
02030 EOLNCK CP 0DH ;C/R ?
02040 RET Z
02050 CP 03H ;ETX
02060 RET ;GO BACK W/ STATUS
02070 ;
02080 ;
02090 CLRBNK LD C,1 ;BANK 1
02100 CALL GETCLR ;BANK 2
02110 LD C,2 ;BANK 2
02120 GETCLR LD B,2 ;BANK AVAL?
02130 PUSH BC ;SAVE #
02140 LD A,BANK
02150 RST 28H ;DO IT

```

Listing 1 continued



keys (0-9) used to control video output speed. ScripAid also bypasses the printer ready test and intercepts the end-of-output routine to restore printer output. It ignores any embedded control codes during video output.

The top-of-form (TOF) and control-code routines send characters directly to the printer. A single byte value, 0C hex, is the standard TOF code. The P,C option calls the SVC @HEXDEC, converting the ASCII decimal input to binary for output to the printer.

Line 5020 is the entry to the printer driver routine. After you save this routine, ScripAid tests the last byte sent. If it's a backslash character (\), ScripAid branches to NXTST, where it checks the current character. (To type a backslash, hit the standard slash key and the clear key at the same time.)

If the current character is something other than a backslash character, ScripAid scans the printer control code table. If ScripAid finds a match, it outputs the appropriate control string from the 90-byte control code list loaded when you called up ScripAid.

Note that ScripAid sends control codes only if the printer (SVC 6) is the active output device. This avoids confusion in the video preview mode. An invalid control code translates to a space character for printer output.

The final portion of the source code defines the messages and storage areas ScripAid uses.

Using ScripAid

As you're writing text, you can embed ScripAid's printer codes directly in your document to activate your printer's special abilities. The Figure shows an example of text with printer codes embedded and of the final product.

ScripAid has two classes of commands: the reassigned Scripsit editing commands and the enhanced com-

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NAME

DESCRIPTION

1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNU1	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEYN	Break-even analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDOB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWTH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLET	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCKVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model: i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQIOQ	Fixed quantity economic order quantity model
53	FQEOQSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	MCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project

59	WACC	Weighted average cost of capital
60	COMBPAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUID	DOPE business bookkeeping system
77	TIMECLK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMEJAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCOMBBD	Investor's rate of return on convertible bond
100	PORTVAL9	Stock market portfolio storage-valuation program

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mands I added. You invoke all of the reassigned Scripsit commands by first hitting the clear key and another key to put you in the appropriate editing mode (clear-D for delete, clear-I for insert, and so on), just as you would with the standard program. Then hit clear and the relevant command key to actually make changes (see Table 1). The reassigned Scripsit commands perform the same functions they did in the original commercial program, so I won't explain them here.

You execute all of my enhanced com-

mands by hitting the break key and an associated character or characters (see Table 1). Query (Q), clears the screen and then, like all ScripAid commands, scans the remainder of the command line for additional parameters, such as a file extension to be matched or a drive specification. Query displays the disk name, creation date, and available space for all visible, non-system files on drive zero as the default. You must specify the extension and/or drive number that you want matched. To return to ScripAid, press any key.

Kill (K) checks for the entry of a valid file name, opens the file, then calls the @REMOV SVC to kill the file from the directory of the specified or default drive. Note that you must first open, like all ScripAid commands, to remove it. When you finish editing text and want to preview what it will look like when it's printed out, press the clear-P-V keys.

Bank (B), followed by any digit from 1 to 3, incorporates the specified 32K memory bank as the active text buffer. Bank 1 is the active bank at power-up and has the largest capacity (35K to 39K depending on your system configuration). Banks 2 and 3 each hold about 32K of text. If a requested bank isn't available, a message is displayed. When switching banks, the selected video line width and paragraph indent are saved or restored.

If you've created your own help file (see Program Listing 5), the ScripAid Help command (H), followed by K (keyboard) or P (printer), calls for the appropriate help screen. These are stored as ASCII files with a record length of 80 bytes. The up- and down-arrow keys page forward and backward through the help file. You should note that the letter H, when not followed by another character, calls for the hyphenation command.

End Notes

As with any enhancement program, it's necessary to create the enhanced commands around the original program. Whenever you do this, however, you must make some compromises, and ScripAid has two of which you should be aware.

The first problem is that the embedded printer control codes aren't treated as invisible format commands by Scripsit's formatting routines. Because of this, full justification (flush-left and -right margins) won't function properly with embedded codes. To eliminate this problem, you can turn off full justification (J=N) and carefully assemble any lines using special functions.

The second problem concerns text that's previewed on the monitor with the P,V command. If the text contains page number blocks, it's video display is marred by momentary flashes of the editing screen whenever it calculates a new page number. You can avoid this problem by leaving out page number blocks until you're ready to print the document. ■

You can write to Clifford Knight at Box 253, Manomet, MA 02345.

Listing 1 continued

```

02160      POP      BC          ;GET #
02170      RET      NZ         ;NZ=NOT AVAIL
02180      LD      B,0         ;SELECT BANK
02190      LD      A,BANK
02200      RST      28H
02210      PUSH    BC          ;SAVE OLD BANK
02220      LD      A,0CH
02230      LD      (0000H),A    ;INTO BUFFER
02240      XOR      A
02250      LD      (0001H),A    ;NO TEXT
02260      POP      BC          ;GET OLD BANK #
02270      LD      A,BANK
02280      RST      28H
02290      RET
02300      ;
02310      ;
02320      ;
02330      BADFIL DEFH 'Invalid filespec!'
02340      DEFH 0DH
02350      *LIST OFF
02360      BADFIL DEFH 'Invalid filespec!'
02370      DEFH 0DH
02380      *LIST ON
02390      ;
02400      ;
02410      DSMSG    PUSH    DE    ;SAVE DE
02420      LD      A,DSPLY    ;SVC, DISPLAY MSG @ (HL)
02430      RST      28H
02440      POP      DE
02450      RET      Z          ;Z= O.K.
02460      LD      L,A        ;L= ERROR CODE
02470      LD      H,00H
02480      OR      0CH        ;SET RETURN BITS
02490      LD      C,A        ;PASS IN "C"
02500      LD      A,ERROR    ;SVC, LOG AN ERROR
02510      RST      28H
02520      JR      DOSXIT     ;RET W/ ERROR
02530      ;
02540      ;
02550      LOGERR   LD      A,LOGOT    ;SVC, DISPLAY & LOG MSG
02560      RST      28H
02570      LD      HL,0FFFFH    ;SET ERROR RETURN
02580      DOSXIT   LD      SP,$-$    ;RESET SP
02590      OLDSP    EQU      $-2
02600      RET          ;GOTO DOS READY
02610      ;
02620      ;
02630      FCB      DEFS      32      ;FCB FOR PDC INPUT
02640      DEFNAM   DEFH 'DEFAULT/'
02650      PDCTXT   DEFH 'PDC'
02660      DEFH 0DH
02670      *LIST OFF
02680      DEFNAH   DEFH 'DEFAULT/'
02690      PDCTXT   DEFH 'PDC'
02700      DEFH 0DH
02710      *LIST ON
02720      ;
02730      BANNER   DEFH 0FH        ;CURSOR OFF
02740      DEFH 1CH        ;HOME CURSOR
02750      DEFH 1FH        ;CLS
02760      DEFH 0CDH
02770      DEFH '*** ScripAid *** (c) 1984 Paladin'
02780      DEFH ' Software'
02790      DEFH 0A0AH
02800      DEFH 0A0AH
02810      DEFH 0A0AH
02820      DEFH 0D4H
02830      DEFH 'Loading driver --> '
02840      DEFH 03H
02850      *LIST OFF
02860      BANNER   DEFH 0FH
02870      DEFH 1CH
02880      DEFH 1FH
02890      DEFH 0CDH
02900      DEFH '*** ScripAid *** (c) 1984 Paladin Softwa..
02910      DEFH 0A0AH
02920      DEFH 0A0AH
02930      DEFH 0A0AH
02940      DEFH 0D4H

```

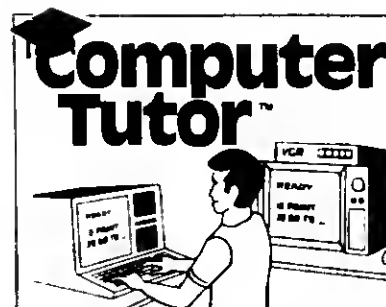
Listing 1 continued

```

02950      DEFB      'Loading driver --> '
02960      DEFB      03H
02970      *LIST ON
02980      ;
02990      ENINIT    EQU      S
03000      ;
03010      ;
03020      ;
03030      ;      *** Start of ScripAid ***
03040      ;
03050      ORG      OLDBUF      ;STARTS @ OLD TEXT BUF
03060      ;
03070      PALBRK    INC      HL      ;HL-> NEXT CHAR
03080      CP      'Q'      ;QUERY?
03090      JR      Z,QUERY    ;IF SO
03100      CP      'K'      ;KILL ?
03110      JP      Z,KILL    ;DO IT
03120      CP      'B'      ;BANK?
03130      JP      Z,BANKS   ;GO TO IT
03140      CP      'H'      ;HELP?
03150      JR      NZ,GOODBK ;NZ= NOT "H"
03160      LD      C,A      ;ELSE SAVE CHAR
03170      LD      A,(HL)    ;GET NEXT CHAR
03180      CP      0DH      ;CR?
03190      JP      NZ,HELP   ;IF NOT, GET HELP
03200      LD      A,C      ;GET ORIG CHAR
03210      GOODBK  LD      HL,BRKTAB ;HL-> BRK PARMS
03220      JP      RETBRK    ;GO BACK
03230      ;
03240      ;
03250      QUERY     CALL     SKPSPL+1 ;SKIP SPACES
03260      JR      Z,NOEXT    ;Z= CR FOUND
03270      CP      '/'      ;EXT SPECIFIED?
03280      CALL     Z,MOVEXT  ;IF FOUND
03290      JR      Z,USREXT
03300      NOEXT     PUSH     HL      ;SAVE CMDLINE PTR
03310      LD      HL,EXTMSG-1 ;HL-> "$$$"
03320      CALL     MOVEXT    ;MOVE TO FCB
03330      POP      HL      ;GET PTR
03340      USREXT   LD      A,(HL) ;GET A CHAR
03350      CP      ':'      ;DRIVE SPECIFIED?
03360      INC      HL
03370      JR      Z,USRDRV   ;IF SO
03380      CP      0DH      ;CR?
03390      JR      NZ,USREXT  ;IF NOT EOLN
03400      LD      (HL),'0'  ;SET DRV #
03410      USRDRV   CALL     CLRVID  ;CLEAN VIDEO
03420      LD      A,(HL)    ;GET DRIVE #
03430      AND     07H      ;0-7 ONLY
03440      LD      C,A      ;INTO C
03450      LD      A,(PARM1),A ;SAVE DRIVE #
03460      LD      HL,SCRPF  ;HL-> BUFFER AREA
03470      LD      B,04     ;SET GET FREE
03480      LD      A,DODIR   ;@DODIR SVC
03490      RST      28H
03500      JP      NZ,DSKERR
03510      LD      HL,DRVMSG  ;HL-> "DRIVE:"
03520      LD      A,DSPLY
03530      RST      28H
03540      LD      A,(PARM1) ;GET DRIVE #
03550      ADD     A,30H     ;CONV TO ASCII
03560      LD      C,A
03570      LD      A,DSF
03580      RST      28H
03590      LD      HL,NAMSG   ;HL-> "Pack ID: "
03600      LD      A,DSPLY
03610      RST      28H
03620      LD      HL,SCRPF  ;HL-> FREE STRING
03630      CALL     EIGHT    ;OUTPUT DISK NAME
03640      PUSH     HL      ;SAVE DISK INFO PTR
03650      LD      HL,CREMSG  ;HL-> "Created:"
03660      LD      A,DSPLY
03670      RST      28H
03680      POP      HL
03690      CALL     EIGHT    ;GET INFO PTR
03700      PUSH     HL      ;OUTPUT CREATION DATE
03710      LD      HL,FREMSG ;SAVE INFO PTR
03720      LD      A,DSPLY   ;HL-> "Free:"
03730      RST      28H
03740      POP      HL
03750      LD      E,(HL)    ;LSB TOTAL SPACE
03760      INC      HL
03770      LD      D,(HL)    ;MSB TOTAL
03780      INC      HL
03790      LD      A,(HL)    ;HL-> LSB FREE
03800      INC      HL
03810      LD      H,(HL)    ;GET MSB
03820      LD      L,A      ;HL= FREE SPACE
03830      PUSH     DE      ;SAVE TOTAL
03840      CALL     KOUT      ;OUTPUT FREESP
03850      LD      C,'/'
03860      LD      A,DSF
03870      RST      28H
03880      POP      DE
03890      EX      DE,HL
03900      CALL     KOUT
03910      LD      HL,BLKLIN ;HL-> @ABDH
03920      LD      A,DSPLY
03930      RST      28H
03940      LD      A,(PARM1) ;GET DRIVE #
03950      LD      C,A
03960      LD      B,2
03970      LD      HL,EXTBUF ;SET DIR F/ "EXT"(HL)
03980      LD      A,DODIR   ;HL-> EXTENSION TO MATCH
03990      RST      28H
04000      LD      A,DODIR
04010      RST      28H
04020      ;DIR TO VIDEO

```

Listing 1 continued



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Listing 1 continued

```

04000 JR NZ,DSKERR
04010 CALL BOTLIN
04020 LD RL,VDMMSG ;CURSOR TO LINE 23
04030 LD A,DSPLY ;HL-> "CONTINUE?"
04040 RST 28H
04050 ;
04060 ;
04070 ;
04080 WAITBK LD A,KEY ;KEY SVC
04090 RST 28H
04100 GOBACK LD C,0FH ;CURSOR OFF
04110 LD A,DSPLY
04120 RST 28H
04130 CALL CLRVID ;CLEAR SCREEN
04140 JP SCRFIN ;BACK TO SCRIPSIT
04150 ;
04160 ;
04170 KILL CALL SKPSPL+1 ;SKIP SPACES
04180 JR Z,GOERR ;IF SO
04190 LD DE,FCB1 ;DE-> FCB
04200 LD A,FSPEC ;@FSPEC
04210 RST 28H
04220 JR NZ,DSKERR
04230 LD B,0 ;LRL=256
04240 LD A,OPEN ;@OPEN TO KILL
04250 RST 28H
04260 JR NZ,DSKERR
04270 LD A,REMOV ;@REMOV
04280 RST 28H
04290 JR NZ,DSKERR
04300 GOBACK
04310 ;
04320 ;
04330 GOERR LD C,0FH ;CURSOR OFF
04340 LD A,DSPLY
04350 RST 28H
04360 JP ERRINV ;INVALID CMD
04370 ;
04380 ;
04390 ;
04400 DSKERR OR 0CBH ;SET RET & MSG
04410 LD C,A ;ERROR -> C
04420 PUSH BC ;SAVE ERROR
04430 CALL BOTLIN ;POSITION CURSOR
04440 POP BC ;GET ERROR
04450 LD A,ERROR ;@ERROR SVC
04460 RST 28H
04470 JR WAITBK
04480 ;
04490 ;
04500 TOP POP HL ;FIX STACK
04510 LD C,0CH ;ASCII FORM FEED
04520 LD A,PRT ;@PRT SVC
04530 RST 28H
04540 JR GOBACK ;BACK TO SCRIPSIT
04550 ;
04560 CONTRL POP AF ;FIX STACK
04570 INC HL ;HL-> NEXT CHAR
04580 CTLP1 CALL SKPSPL+1 ;SKIP SPACES
04590 JP Z,GOBACK ;IF END
04600 CP ',' ;DELIMITER ?
04610 JR NZ,CONT1
04620 INC HL ;ELSE BUMP PAST
04630 CONT1 LD A,DECHX ;@DECHX SVC
04640 RST 28H
04650 LD A,PRT
04660 RST 28H
04670 JR CTLP1 ;LOOP
04680 ;
04690 VIDEO LD A,02H ;@DSP SVC
04700 LD (OUTSVC),A ;SET VIDEO SVC
04710 LD A,0EFH ;RST 28H OPCODE
04720 LD (PASRST),A ;INTO @DELAY CALL
04730 LD HL,0C9AFH ;XOR A & RET OPCODES
04740 LD (PRTCHK),HL ;INTO CHECK ROUT
04750 LD HL,VDMWAIT ;HL-> END WAIT ROUT
04760 LD (PRENO),HL ;INTO SCRIPSIT VECTOR
04770 LD A,0CDH ;CALL OPCODE
04780 LD (KSCAN),A ;INTO SCRIPSIT
04790 LD HL,DLYCK ;HL-> DELAY CK ROUT
04800 LD (KSCAN+1),HL ;INTO SCRIPSIT
04810 CALL BOTLIN
04820 OR A ;RESET CARRY FLAG
04830 RET ;GO BACK & OUTPUT
04840 ;
04850 ;
04860 ;
04870 PRTCNT LD A,06H ;@PRT SVC
04880 LD (OUTSVC),A ;STORE IT
04890 LD HL,0D5C5H ;PUSH BC & PUSH DE
04900 LD (PRTCHK),HL ;STORE THEM
04910 LD HL,000T ;HL-> FORMAT OUT ROUT
04920 LD (PRENO),HL ;RESET VECTOR
04930 LD A,28H ;JR Z OPCODE
04940 LD (KSCAN),A ;JR 2 BYTES, XOR A
04950 LD HL,0AF02H ;RESET JUMP
04960 LD (KSCAN+1),HL ;NOP OPCODE
04970 XOR A ;INTO @DELAY CALL
04980 LD (PASRST),A ;GO BACK
04990 RET
05000 ;
05010 ;
05020 PRTOUT PUSH HL ;SAVE CURRENT CHAR
05030 PUSH DE ;SAVE ACCUM
05040 PUSH AF
05050 PUSH BC

```

Listing 1 continued

```

05060 LD A,S-S ;GET PREV CHAR
05070 PRVCHR EQU S-1
05080 CP '\'; ;"\?"
05090 LD A,C ;GET CURRENT CHAR
05100 JR Z,NXTST ;IF PREVIOUS="\
05110 SAVPRV CP '\';
05120 LD (PRVCHR),A ;SAVE AS PREVIOUS
05130 JR Z,PRTXIT ;IF CURR="\, NO ACT
05140 MOSET LD BC,0301H ;DELAY COUNT
05150 LD A,PAUSE ;@PAUSE SVC
05160 PASRST NOP ;INIT IN "PRINT"
05170 POP BC ;GET CHAR
05180 PUSH BC ;SAVE AGAIN
05190 LD A,PRT ;@PRT SVC
05200 OUTSVC EQU S-1
05210 RST 28H
05220 PRTXIT POP BC
05230 SKPOUT POP AF ;RESTORE ACCUM
05240 POP DE ;GET DE
05250 POP NL
05260 RET ;DONE
05270 ;
05280 ;
05290 NXTST CP '\'; ;2nd "\?"
05300 JR NZ,CTLCK ;IF SO
05310 SAVSPC LD A,28H ;" "
05320 JR SAVPRV ;SAVE AS PREV
05330 ;
05340 ;
05350 CTLCK LD A,(OUTSVC) ;GET OUTPUT SVC
05360 CP 02H ;@DSP?
05370 POP BC ;GET CURRENT CHAR
05380 JR NZ,CTLCK1 ;NZ=@PRT
05390 LD A,20H ;ASCII SPACE
05400 LD (PRVCHR),A ;SAVE AS PREVIOUS
05410 JR SKPOUT ;SKIP OUTPUT
05420 ;
05430 ;
05440 ;
05450 CTLCK1 LD NL,CTLTAB ;HL-> CTL STRINGS
05460 LD DE,LOOKTB ;DE-> LOOKUP TABLE
05470 LD B,18 ;18 CODES
05480 LOOKLP LD A,(DE) ;GET ONE
05490 INC DE ;DE-> NEXT CODE
05500 CP C ;MATCH?
05510 JR Z,CTLFND ;IF SO
05520 INC NL
05530 INC HL
05540 INC NL
05550 INC HL ;5 BYTES/ENTRY
05560 INC HL ;HL-> NEXT CTL STRS
05570 DJNZ LOOKLP ;LOOP
05580 LD C,20H ;ELSE PASS A SPACE
05590 CHRNUL PUSH BC ;SAVE AS CURRENT
05600 JR SAVSPC ;GO DO IT
05610 ;
05620 CTLFND LD B,05H ;5 BYTES/CTL S
05630 CTLOOP LD C,(HL) ;GET ONE
05640 INC HL ;HL-> NEXT
05650 INC C
05660 JR Z,CTLDON ;Z= END OF CTL S
05670 DEC C ;RESTORE
05680 LD A,PRT ;@PRT SVC
05690 RST 28H
05700 DJNZ CTLOOP ;LOOP
05710 ;
05720 CTLDON XOR A ;CLEAR ACCUM
05730 LD C,A ;SET A NULL
05740 JR CHRNUL ;OUTPUT NULL, SAVE " "
05750 ;
05760 ;
05770 DLYCK JR NZ,CCKN1 ;IF NOT <SFT><CLR>
05780 CALL PRTCNT ;RESET *PR OUTPUT
05790 LD HL,PARETN ;HL-> CONT ROUT
05800 LD (RETVEC),HL ;INTO RET VECTOR
05810 JP PRCLN ;CONTINUE
05820 ;
05830 CCKN1 CP '@'; ;PAUSE ?
05840 JR NZ,CCKN2 ;IF NOT
05850 PUSH DE ;SAVE TEXT PTR
05860 LD A,KEY ;@KEY SVC
05870 RST 28H ;WAIT
05880 POP DE
05890 CCKN2 SUB 30H ;CONVERT TO DEC
05900 JR C,NOTNUM ;>"9"?
05910 CP 0AH
05920 JR NC,NOTNUM
05930 LD (MOSET+2),A ;INTO CODE ABOVE
05940 NOTNUM XOR A
05950 RET
05960 ;
05970 ;
05980 CLRVID PUSH HL
05990 LD HL,CLRMSG ;HL-> CLS STRING
06000 LD A,DSPLY
06010 RST 28H
06020 POP HL
06030 RET ;DONE
06040 ;
06050 ;
06060 ;
06070 VDNWAIT CALL DOUT ;DO OUTPUT
06080 PUSH DE
06090 PUSH HL ;SAVE REGS
06100 CALL BOTLIN ;POS'N CURSOR

```

Listing 1 continued

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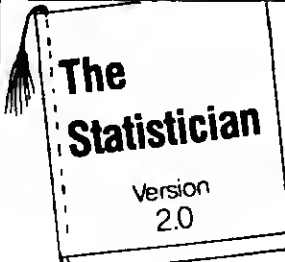
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Listing 1 continued

```

06118      EI
06120      LD      HL,VDMSG      ;HL-> HIT RET TO CONT
06130      LD      A,DSPLY
06140      RST      2BH
06150      LD      A,KEY        ;RKEY
06160      RST      2BH
06170      LD      C,8FH        ;CURSOR OFF
06180      LD      A,DSF        ;BDSP SVC
06190      RST      2BH
06200      POP      HL
06210      POP      DE
06220      JP      PRTCNT
06230      ;
06240      ;
06250      EIGHT LD      B,B      ;8 BYTES
06260      EIL00P LD      C,(HL)  ;GET A BYTE
06270      LD      A,DSF
06280      RST      2BH
06290      INC      HL          ;HL-> NEXT BYTE
06300      DJNZ     EIL00P
06310      RET
06320      ;
06330      ;
06340      R0UT  LD      DE,SCRPF  ;DE-> BUFFER
06350      PUSH    DE          ;SAVE BUFFER START
06360      LD      A,HEXDEC
06370      RST      2BH
06380      POP      HL          ;HL-> BUFFER
06390      LD      B,5
06400      CALL    EIL00P      ;OUTPUT 5 BYTES
06410      LD      C,'K'
06420      LD      A,DSF
06430      RST      2BH
06440      RET
06450      ;
06460      ;
06470      MOVEXT PUSH    AF      ;SAVE CHAR
06480      LD      B,3          ;3 CHARS/EXT
06490      LD      DE,EXTBUF    ;DE-> EXT BUFFER
06500      EXTLP  INC      HL      ;BUMP PTR
06510      LD      A,(BL)      ;GET A CHDLINE CHAR
06520      CP      '8'
06530      JR      C,FILLUP    ;C= '<B'
06540      CP      '9'+1
06550      JR      C,0KEXT     ;C= '8'-'9'
06560      AND      5FH        ;FOLD -> U/C
06570      CP      'A'
06580      JR      C,FILLUP    ;C= '>'9', '<'A'
06590      CP      '2'+1
06600      JR      NC,FILLUP    ;NC= '>'2'
06610      0KEXT LD      (DE),A  ;INTO BUFFER
06620      INC      DE          ;BUMP PTR
06630      DJNZ     EXTLP      ;LOOP
06640      POP      AF
06650      RET
06660      ;
06670      FILLUP LD      A,'S'  ;WCC
06680      DEC      HL          ;BACKUP PTR
06690      JR      0KEXT
06700      ;
06710      ;
06720      ;
06730      ;
06740      BOTLIN LD      HL,1700H ;LINE 23, COL 0
06750      LD      B,03H        ;SET CURSOR OF
06760      LD      A,VDCTL      ;@VDCTL SVC
06770      RST      2BH
06780      LD      C,1EH        ;CLEAR TO END OF LINE
06790      LD      A,DSF        ;@DSF SVC
06800      RST      2BH
06810      RET
06820      ;
06830      ;
06840      CKPARN  PUSH    DE      ;SAVE CMD LINE PTR
06850      CALL    PRPHCK      ;LOOK F/,P,1 ETC
06860      POP      HL          ;HL-> CMD LINE
06870      RET      NC          ;NC= PARM FOUND
06880      LD      A,(HL)      ;ELSE GET NEXT CHAR
06890      CP      'V'
06900      JP      Z,VIDEO     ;VIDEO ?
06910      CP      'T'
06920      JP      Z,TOP       ;IF 50
06930      CP      'C'
06940      JP      Z,CONTRL    ;TOP OF FORM ?
06950      SCF                ;CONTROL CODES?
06960      RET                ;ELSE SET CARRY
06970      ;
06980      ;
06990      HELP  CALL    SKPSPC  ;SKIP SPACES
07000      SUB      'P'        ;PRINTER HELP?
07010      LD      HL,HLPPF    ;HL-> REG HELPPF
07020      LD      A,11
07030      JR      NZ,GETHLP    ;12 PAGES IN MAIN HELP
07040      LD      HL,PHLPF    ;BL-> PRINTER FS
07050      XOR      A           ;MAX PAGE=0
07060      GETHLP LD      (MAXPAG),A ;SAVE MAX PAGE #
07070      LD      DE,FCB1     ;DE-> FCB
07080      LD      A,FSPEC      ;@FSPEC
07090      RST      2BH
07100      JP      NZ,DSKERR
07110      LD      A,OPEN
07120      LD      B,0B
07130      LD      HL,SCRPF     ;@OPER
07140      RST      2BH        ;0B BYTE LRL
07150      JP      NZ,DSKERR   ;HL-> BUFFER
07160      PAGE0 XOR      A      ;CURRENT PAGE = 0

```

Listing 1 continued

```

07170 SAVPAG LD (PARM1),A ;SAVE CURR PAGE 0
07180 CALL DSPPAG ;OUTPUT A PAGE
07190 JP NZ,DSKERR
07200 CALL BOTLIN ;CURSOR @ LINE 23
07210 LD HL,HLPMSG
07220 LD A,DSPLY ;@DSPLY
07230 RST 28H
07240 HLPLP LD A,KEY ;@KEY
07250 RST 28H
07260 CP 0AH ;DOWN ARROW
07270 RST 28H
07280 CP 0AH ;DOWN ARROW
07290 JR Z,NXTPAG ;UP ARROW ?
07300 CP 0BH
07310 JR Z,PRVPAG
07320 LD DE,FCB1 ;LOOP IF NOT
07330 LD A,CLOSE
07340 RST 28H
07350 JP NZ,DSKERR
07360 JP GOBACK
07390 ;
07400 PRVPAG LD A,(PARM1) ;GET CURR PAGE 0
07410 OR A ;TEST IT
07420 JR NZ,DECPAG ;NZ, CURR<0
07430 LD A,(MAXPAG) ;ELSE GET LAST 0
07440 INC A
07450 DECPAG DEC A
07460 JR SAVPAG ;GO TO IT
07470 ;
07480 NXTPAG LD HL,MAXPAG ;HL-> MAXPAGE 0
07490 LD A,(PARM1) ;A= CURR 0
07500 CP (HL) ;TEST
07510 JR Z,PAGE0 ;IF AT MAX
07520 INC A ;ELSE BUMP 0
07530 JR SAVPAG ;DO IT
07540 ;
07550 DSPPAG SLA A ;A= PAGE*4
07560 SLA A ;SAVE IT
07570 LD C,A
07580 SLA A
07590 SLA A ;A= PAGE*16
07600 ADD A,C ;A= PAGE*20
07610 LD C,A ;INTO C
07620 LD B,00H ;BC= REC 0
07630 LD DE,FCB1 ;DE-> FCB
07640 LD A,POSN ;@POSN SVC
07650 RST 28H
07660 RET NZ
07670 CALL CLRVID
07680 LD B,20 ;20 LINES/PAGE
07690 PAGLP PUSH BC ;SAVE LINE COUNT
07700 LD DE,FCB1
07710 LD A,READ ;@READ
07720 LD HL,LINBUF ;@0 CHAR BUFFER
07730 PUSH HL ;SAVE IT
07740 RST 28H
07750 POP HL ;HL-> LINE START
07760 LD A,0DH ;C/R
07770 LD (LINBUF+79),A ;FLAG END OF LINE
07780 LD A,DSPLY ;@DSPLY
07790 RST 28H
07800 POP BC ;GET COUNT
07810 DJNZ PAGLP ;ELSE DONE
07820 RET
07830 ;
07840 ;
07850 BANKS CALL SKPSPL+1 ;GET NEXT & SKIP " "
07860 SUB 31H ;CONVERT TO BINARY
07870 JR C,BNKERR
07880 CP 03H ;>"2"?
07890 JR NC,BNKERR
07900 LD C,A ;GET BANK 0 IN C
07910 PUSH BC ;SAVE IT
07920 LD B,02 ;BANK AVAIL?
07930 LD A,BANK ;@BANK SVC
07940 RST 28H
07950 POP BC ;FIX STACK/GET BANK#
07960 JR NZ,BNKERR ;IF ERROR
07970 PUSH BC ;SAVE IT
07980 ;
07990 LD HL,CSRET ;HL-> RET ADDR
08000 PUSH HL ;SET SAME
08010 LD A,1BH ;<SHIFT><UP>
08020 JP 390EH ;GO DO IT
08030 ;
08040 CSRET LD (SECCH),DE ;SAVE CURRENT LOC
08050 CALL BNK23 ;SET PTRS
08060 POP BC ;GET BANK 0
08070 LD A,C ;INTO A
08080 PUSH BC ;SAVE AGAIN
08090 OR A ;TEST IT
08100 CALL Z,BNKONE ;IF Z, SPECIAL RESET
08110 LD A,(CURBNK) ;GET CURRENT BANK
08120 CALL FRDBNK ;HL-> STRG AREA
08130 SVBNKL LD E,(IX+0)
08140 LD D,(IX+1) ;DE-> ADDR TO MOVE
08150 CALL MOVPTX ;MOVE IT
08160 DJNZ SVBNKL ;LDOP
08170 POP BC ;GET REQUESTED BANK#
08180 PUSH BC ;SAVE AGAIN
08190 LD B,0 ;SET SELECT FUNCTION
08200 LD A,BANK ;@BANK SVC
08210 RST 28H ;SET NEW BANK
08220 LD B,1 ;RESET "OLD" BANK

```

Listing 1 continued

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```
09590 DEFM 0005H
09760 DEFM 0044H
09710 /
09720 /
09730 /... MESSAGES ...
09740 /
09750 CLMSG DEFB 1CH
09760 DEFB 1FH
09770 DEFB 03H
;HOME CURSOR
;CLEAR TO END OF SCREEN
;ASCII ETC
09780 /
09790 BKLIN DEFB BAX
09800 DEFB BDH
;BLANK LINE
09810 /
09820 VDMSC DEFM 'Nit <ENTER> to continue...'
09830 DEFB BZH
;CURSOR ON
09840 DEFB B3H
09850 /
09860 DRVMSG DEFB BC3H
09870 DEFB 'Drive: '
09880 DEFB B3H
09890 /
09900 NAMEC DEFB BC3H
09910 DEFB 'Pack ID: '
09920 DEFB B3H
09930 /
09940 CREMSG DEFB BC3H
09950 DEFB 'Created: '
09960 DEFB B3H
09970 /
09980 FREMSG DEFB BC3H
09990 DEFB 'Free: '
10000 DEFB B3H
10010 /
10020 EXTMSG DEFM '$$$'
10030 /
10040 HLPMSG DEFM 'Use up/down arrows to page, <BREAK> to return to scriptaid...'
10050 DEFB BEN
10060 DEFB B3H
10070 /
10080 HLPFS DEFM 'ScriptAid/HLP'
10090 DEFB BDH
10100 /
10110 BNKMSG DEFM 'Bank NOT available'
10120 DEFB B3H
10130 /
10140 LOOKTB DEFM '112'304$56z7'
10150 DEFB ZTH
10160 DEFB 'B(9)'
10170 /
10180 LIBT DFF
10190 VDMSC DEFM 'Hit <ENTER> to continue...'
10200 DEFB BEN
10210 DEFB B3H
10220 DRVMSG DEFB BC2H
10230 DEFM 'Drive: '
10240 DEFB B3H
10250 NAMSG DEFB BC3H
10260 DEFM 'Pack ID: '
10270 DEFB B3H
10280 CREMSG DEFB BC3H
10290 DEFM 'Created: '
10300 DEFB B3H
10310 FREMSG DEFB BC3H
10320 DEFM 'Free: '
10330 DEFB B3H
10340 EXTMSG DEFM '$$$'
10350 HLPMSG DEFM 'Use up/down arrows to page, <BREAK> to return to scriptaid...'
10360 DEFB BEN
10370 DEFB B3H
10380 HLPFS DEFM 'ScriptAid/HLP'
10390 DEFB BDH
```

18400	BNKNG	DEFP	'BANK NOT available'
03H			
18410	DEFB		
18420	LOOKTB	DEFP	'112*304850647'
18430	DEFB		
18440	DEFP		
18450	*LIST ON	DEFP	'B(9)'
18460			
18470			
18480	CTLTAB	DEFS	
18490			
18500	LINBUF	DEFS	
18510			
18520	EXTBUF	DEFS	
18530			
18540	FCB1	DEFS	
18550			
18560	PHLPFS	DEFS	
18570			
18580	PARM1	DEFB	
18590	MAXPAG	DEFB	
18600			
18610	LAST	DEFL	
18620			
18630			
18640			
	END	ENTRY	

Program Listing 2. Rekey/SRC, the source code for keyboard and message modifications.

```

***** MEMORY *****
000110 / Mnemonic keyboard overlay for Model 4 SCRIPTSIT
000112 /
000113 /
000114 /
000115 /
000116 /
000117 /
000118 /
000119 /
000120 /
000121 /
000122 /
000123 /
000124 /
000125 /
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000131 /
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000135 /
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000137 /
000138 /
000139 /
000140 /
000141 /
000142 /
000143 /
000144 /
000145 /
000146 /
000147 /
000148 /
000149 /
000150 /
000151 /
000152 /
***** Patches for keyboard commands *****
<CLR>X>-> <CLR>L>, Line - Insert routine
ORG 3D79H
DEFB 8CCH
<CLR>Q>-> <CLR>XB>, Block - Insert routine
ORG 3D7DH
DEFB 8C2H
<CLR>W>-> <CLR>Z>, Window - Main Commands
ORG 5E29H
DEFB 8DAH
<CLR>Q>-> <CLR>XB>, Block
ORG 5E29H
DEFB 8C2H
<CLR>XS>-> <CLR>XI>, Insert - Main Commands
ORG 5E2DH
DEFB 8C9H
<CLR>X>-> <CLR>L>, Line - Main Commands
<CLR>C>-> <CLR>G>, ParaGraph
<CLR>V>-> <CLR>N>, New page
ORG 5E30H
DEFB 8CCH
DEFB 8C7H
DEFB 8CEH
<CLR>F>-> <CLR>S>, Spaces - Delete routine
<CLR>X>-> <CLR>L>, Line
<CLR>C>-> <CLR>G>, ParaGraph
ORG 5E49H
DEFB 8D3H
DEFB 8CCH
DEFB 8C7H
DEFB 8CEH
<CLR>Z>-> <CLR>W>, Word - Delete routine
ORG 5E50H
DEFB 8D10H
DEFB 8D40H
DEFB 8D50H
DEFB 8D60H
DEFB 8D70H
DEFB 8D80H
DEFB 8D90H
DEFB 8DA0H
DEFB 8DB0H
DEFB 8DC0H
DEFB 8DD0H
DEFB 8DE0H
DEFB 8DF0H
DEFB 8E00H
DEFB 8E10H
DEFB 8E20H
DEFB 8E30H
DEFB 8E40H
DEFB 8E50H
DEFB 8E60H
DEFB 8E70H
DEFB 8E80H
DEFB 8E90H
DEFB 8EA0H
DEFB 8EB0H
DEFB 8EC0H
DEFB 8ED0H
DEFB 8EE0H
DEFB 8EF0H
DEFB 8F00H
DEFB 8F10H
DEFB 8F20H
DEFB 8F30H
DEFB 8F40H
DEFB 8F50H
DEFB 8F60H
DEFB 8F70H
DEFB 8F80H
DEFB 8F90H
DEFB 8FA0H
DEFB 8FB0H
DEFB 8FC0H
DEFB 8FD0H
DEFB 8FE0H
DEFB 8FF0H
DEFB 9000H
DEFB 9010H
DEFB 9020H
DEFB 9030H
DEFB 9040H
DEFB 9050H
DEFB 9060H
DEFB 9070H
DEFB 9080H
DEFB 9090H
DEFB 90A0H
DEFB 90B0H
DEFB 90C0H
DEFB 90D0H
DEFB 90E0H
DEFB 90F0H
DEFB 9100H
DEFB 9110H
DEFB 9120H
DEFB 9130H
DEFB 9140H
DEFB 9150H
DEFB 9160H
DEFB 9170H
DEFB 9180H
DEFB 9190H
DEFB 91A0H
DEFB 91B0H
DEFB 91C0H
DEFB 91D0H
DEFB 91E0H
DEFB 91F0H
DEFB 9200H
DEFB 9210H
DEFB 9220H
DEFB 9230H
DEFB 9240H
DEFB 9250H
DEFB 9260H
DEFB 9270H
DEFB 9280H
DEFB 9290H
DEFB 92A0H
DEFB 92B0H
DEFB 92C0H
DEFB 92D0H
DEFB 92E0H
DEFB 92F0H
DEFB 9300H
DEFB 9310H
DEFB 9320H
DEFB 9330H
DEFB 9340H
DEFB 9350H
DEFB 9360H
DEFB 9370H
DEFB 9380H
DEFB 9390H
DEFB 93A0H
DEFB 93B0H
DEFB 93C0H
DEFB 93D0H
DEFB 93E0H
DEFB 93F0H
DEFB 9400H
DEFB 9410H
DEFB 9420H
DEFB 9430H
DEFB 9440H
DEFB 9450H
DEFB 9460H
DEFB 9470H
DEFB 9480H
DEFB 9490H
DEFB 94A0H
DEFB 94B0H
DEFB 94C0H
DEFB 94D0H
DEFB 94E0H
DEFB 94F0H
DEFB 9500H
DEFB 9510H
DEFB 9520H
DEFB 9530H
DEFB 9540H
DEFB 9550H
DEFB 9560H
DEFB 9570H
DEFB 9580H
DEFB 9590H
DEFB 95A0H
DEFB 95B0H
DEFB 95C0H
DEFB 95D0H
DEFB 95E0H
DEFB 95F0H
DEFB 9600H
DEFB 9610H
DEFB 9620H
DEFB 9630H
DEFB 9640H
DEFB 9650H
DEFB 9660H
DEFB 9670H
DEFB 9680H
DEFB 9690H
DEFB 96A0H
DEFB 96B0H
DEFB 96C0H
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DEFB 96E0H
DEFB 96F0H
DEFB 9700H
DEFB 9710H
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DEFB 9770H
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DEFB A160H
DEFB A170H
DEFB A180H
DEFB A190H
DEFB A1A0H
DEFB A1B0H
DEFB A1C0H
DEFB A1D0H
DEFB A1E0H
DEFB A1F0H
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DEFB A2A0H
DEFB A2B0H
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DEFB A2F0H
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DEFB A380H
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DEFB A3A0H
DEFB A3B0H
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DEFB A410H
DEFB A420H
DEFB A430H
DEFB A440H
DEFB A450H
DEFB A460H
DEFB A470H
DEFB A480H
DEFB A490H
DEFB A4A0H
DEFB A4B0H
DEFB A4C0H
DEFB A4D0H
DEFB A4E0H
DEFB A4F0H
```

Listing 2 continued

```

00530      ORG 5E5DH
00540      DEFB 0D7H
00550      <CLR><Q>-> <CLR><B>, Block - Exchange routine
00560      <CLR><Q>-> <CLR><W>, Word
00570      <CLR><C>-> <CLR><G>, Paragraph
00580      ORG 5E95H
00590      DEFB 0C2H
00600      DEFB 0D7H
00610      DEFB 0C7H
00620
00630      *** Patches to default values ***
00640      Patch Video Width to 68 characters
00650      ORG 3975H
00660      DEFB 68
00670
00680      Patch left & right margins to 6 & 74
00690      ORG 5E9FH
00700      DEFB 6
00710      DEFB 74
00720
00730      Patch justification = no
00740      ORG 5EA2H
00750      DEFB 'N'
00760
00770      *** Patch Sign-on Banner ***
00780      ORG 3E9BH
00790      DEFB 78, 'LENGTH OF MESSAGE'
00800      DEFB 'C. Knight'
00810      (c) 1984 by Paladin Software - C. Knight
00820
00830      *** Patches to system messages ***
00840      ORG 3P4CH
00850      DEFB 'insert command mode'
00860      ORG 438FH
00870      DEFB 'lock command mode'
00880      ORG 43A2H
00890      DEFB 'delete command mode'
00900      ORG 43B6H
00910      DEFB 'exchange command mode'
00920      ORG 43CCH
00930      DEFB 'delete or Unmark block (D or U)?'
00940      ORG 43EEH
00950      DEFB 'dd, Even or Standard (O, E, or S)?'
00960      ORG 4413H
00970      DEFB 'ame of block to insert?'
00980      ORG 442DH
00990      DEFB 'ame of block to exchange?'
01000      ORG 4F4EH
01010      DEFB 'found'
01020      ORG 4E53H
01030      DEFB 'deleted'
01040      ORG 4E5EH
01050      DEFB 'replaced'
01060      ORG 4E68H
01070      DEFB 'annot find'
01080      ORG 4E75H
01090      DEFB 'characters free:'
01100      ORG 4E87H
01110      DEFB 'document length:'
01120      ORG 4E99H
01130      DEFB 'idea line width:'
01140      ORG 4EACH
01150      DEFB 'paragraph indent:'
01160
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01990
02000
END

```

```
BUILD Scriptaid/JCL11
MEMORY(CLEAR)
LOAD SCRIPSIT/CMD
LOAD REXEX/OVL
LOAD ENHANCE/OVL
```

Program Listing 4. Driver, a Basic program to create a printer driver.

```

10 CLS:PRINT A-Z;DIM PTRCLS(17),DEFTCLS(17):CLS=CHR$(31):GOTO 60000
20 GETLN$=INKEY$:IF SEL$="" THEN 190
30 IF INSTR(VERS$,SEL$)=0 THEN SOUND 2,0,GOTO 100 ELSE RETURN
40 IF INSTR(MY$%,SEL$)=0 THEN SOUND 2,0,GOTO 100 ELSE RETURN
50 IF SEL$=CHR$(13) THEN RETURN
60 IF SEL$=CHR$(8) AND LEN(GTSTR$)>0 THEN PRINT SEL$:GTSTR$=LEFT$(GTSTR$,LEN(GTSTR$)-1):GOTO 200
70 IF SEL$="" AND LEN(GTSTR$)<{FLD THEN PRINT SEL$:GTSTR$=GTSTR$+SEL$:GOTO 20
80 ELSE 200
90 PRINT TAB((4-LEN(HEAD$)/2);HEAD$;RETURN

```

```

000000 PRINT$(19,0);CUR$;"CODE$=FNIV$( " \ " MID$(CTLN,1) " " );
000000 PRINT TAB(8);ENTER decimal codes for embedded command "CODE$
000000 FOR J=0 TO 4
000000 PRINT$(2,J+15+1);CLAS=code "FNIV$(STR$(J+1) " " );
000000 INPUT$(10238) INPUT$(2,J+15+1); THEN CD=255;GOTO 11000
000000 PRINT$(2,J+15+1);IF CD$=" " THEN CD=255;GOTO 11000
000000 CD=VAL(CD$);IF NOT(CD<0 OR CD>254) THEN 11000
000000 PRINT$(12,10); "***** ILLEGAL VALUE ***** " )+ <ENTER> to continue.
000000 PRINT$(12,10); "***** ILLEGAL VALUE ***** " )+
000000 INPUT ENS;GOTO 10030
000000 PRINT$(11,1600) MID$(PRCTCLS(CTLNUM-1),J+1,1)=CHR$(CD);IF CD=255 THEN J=J+1;IF J<5 THEN 11
000000 NEXT J;Y=INT((CTLNUM/2)+.5)+7;X=ABS(CTLNUM MOD 2-1)*33+14
000000 NEXT J;Y=INT((CTLNUM/2)+.5)+7;X=ABS(CTLNUM MOD 2-1)*33+14
000000 PRINT$(Y,X);FOR J=1 TO 5
000000 CODE=ASC(MID$(PRCTCLS(CTLNUM-1),J,1))
000000 IF CODE=255 THEN PRINT " " , ELSE PRINT USING"####";CODE;
000000 PRINT J
000000 PRINT$(19,0);CUR$;"PRINT TAB(6) "current HELP screen entry for "CODE$ " is:

```

```

111070 PRINT TAB(5):GET 3,CITNUM+2:PRINT LEFT$(MENU$,70)
111800 PRINT$(21,5),"enter new HELP line or <ENTER> for no change...SEL$:=""
111980 PRINT$(42,6),CLR$:PRINT TAB(5):CODE$=""
112100 IF CTRPS<>" THEN SEL$=MENU$+"MIDS(CTL$,CITNUM,1)*"+CTSTR$:PUT
113100 IF CTRPS=>" THEN SEL$=MENU$+"MIDS(CTL$,CITNUM,1)*"+CTSTR$:PUT
113300 CTRP=CITNUM-1:SEL$:INKEY$:GOTO 50090 ELSE 50090
22000 PUR 1,1,GOTO 52000
330000 SPESCS="default/pdc":DRVFS="OPEN":"2,SPESCS,90
330010 FOR J=0 TO 17:FIELD 2,5,J AS DUMW2$:5 AS DEFCTL$(J):LSET DEFCTL$(J)=PRCTC
LS$(J):NEXT J
33020 PUT 2,1:CLOSE 2:MSPCS="default/hlp":DRVFS="OPEN":"r",2,MSPCS,00:FIELD 2,00 A
S DEFPMENUS
330300 FOR J=1 TO 20:GET 3,J:LSET DEFPMENUS=MENU$:PUT 2,J:NEXT:GOTO 52000
50000 PRINT$(6,0),CLR$:
50010 HEAD$=driver ID - "PNIVIS(" +%SPESCS+" ")+" the following code
S are assigned..." :GOSUB 500
50020 GET 1,1
50030 PRINT$(8,0),CLR$:
50040 FOR J=1 TO 18 STEP 2:FOR K=0 TO 1
50050 PRINT TAB(9+K,3)PNIVIS(" "+MIDS(CTL$,J+K,1)+") ":"=":
50060 FOR L=1 TO 5:CODE=ASC(MIDS(PRCTL$(J+K),L,1))
50070 IF CODE=255 THEN L=L-5 ELSE PRINT USING####;CODE;
50080 NEXT L:NEXT K:PRINT:NEXT J
50090 PRINT$(19,0),CLR$:PRINT TAB(8)PNIVIS(" key") to alter
file <> to abort )
50100 PRINT$(21,10),"enter selection..." :VERFS=CTL$+Sel$a:"GOSUB 100
50110 CITNUM-INSTR(CTL$,SEL$):IF CITNUM>0 THEN 10000 ELSE PRINT$(6,0),CLR$:
50120 IF SEL$="A" OR SEL$="*" THEN SAV=0:GOTO 52000 ELSE SAV=-1
50130 PRINT$(16,12),CLR$:"save as..."

```

```

5 SYSTEM"system(blink=95)"
10 CLOSEPN=C",1",ScrlPALD/hlp:1".80:FIELD 1,79 AS HS,1 AS CR$
20 LSET CN$=CHR$(13):INPUT "Page 1:PAG=PAG-PAG-1
30 LSET HS=""
40 ***** ScrlPALD ***** by Paladin Software
50 Page+STR$(PAG+1):PUT 1,1:PAG+20:CLS:PRINT LET$(HS,79)
60 LSET HS=STRING$(79,32):PRINT:PUT 1,2:PAG+20
70 FOR J=3 TO 20:GET 1,J:PAG+20:PRINT LET$(HS,79):NEXT
80 PRINT$(22,3):CHR$(16) Enter line to edit (-30), <C to clear page, <S to s
ave page <CR$(17) CHR$(30):HX$=""GOSUB 100:SEL$=X$
90 LIN=VAL(SEL$):IF LIN=0 THEN 1000
100 IF LIN<3 OR LIN>20 THEN 60 ELSE PRINT$(LIN,1,0):HX$=""GOSUB 100:HLP$=X$
110 LSET HS=HLP$:PUT 1,LIN+PAG+20:GOTO 60
120 LSET AS=INKEY$:IF AS="" THEN 100 ELSE IF AS=CHR$(13) THEN RETURN
130 IF AS=CHR$(8) THEN AS="" THEN PRINT AS:X$=LEFT$(X$,LEN(X$)-1):GOTO 100
140 IF AS=CHR$(31) THEN PRINT AS:X$=AS+AS:GOTO 100
150 IF SEL$="C" OR SEL$="C" THEN FOR J=3 TO 20:LSET HS=STRING$(79,32):LSET CR$=
CHR$(13):PUT 1,J:PAG+20:NEXT:GOTO 30
160 IF SEL$="S" OR SEL$="S" THEN PAG=PAG+1:GOTO 10
170 IF SEL$="" THEN CLOSE:CLS
180 IF SEL$="" THEN CLOSE:CLS
190 IF SEL$="" THEN CLOSE:CLS
200 IF SEL$="" THEN CLOSE:CLS

```

find

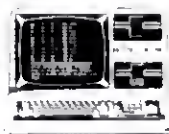
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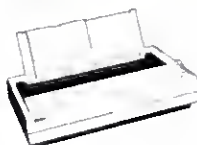
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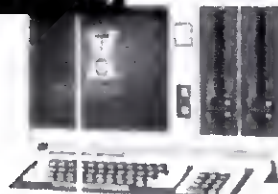


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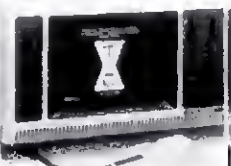


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NOVA CALC

Whether you're making five-year fiscal projections or managing your home budget, NovaCalc tracks your finances with all the features of a commercial spreadsheet.

by Daniel Garms

Forget your balance sheets and home-budget programs. Here's a full-featured, menu-driven Model I/III spreadsheet that gives you all the capabilities of its commercial counterparts, including a rapid-entry mode that lets you enter information into the spreadsheet without waiting for the program to recalculate related values.

NovaCalc also totals and averages a series of cells and has a built-in four-function calculator that lets you make calculations before entering the results in the spreadsheet. It accepts label (text), numeric, and formula entries of up to 12 characters.

Operating NovaCalc

When you run NovaCalc, it prompts you to select 1-, 2-, 3-, or 4-digit precision and to choose from four spreadsheet formats (24 columns by 26 rows, 16 by 39, 12 by 52, or 8 by 78). NovaCalc then displays the spreadsheet with a command prompt and cell status line at the top of the screen.

NovaCalc provides a total of 624 cells. You identify cells by column and row. For example, A01 represents the cell at column A, row 1. Use the arrow keys to move the cell pointer (cursor) from cell to cell.

The slash key (/) puts NovaCalc in the command mode. Press this key and a list of commands appears at the screen top. NovaCalc supports 13 commands (see Table 1). You invoke the desired command by pressing its first character.

The clear key is the escape character. Press it to cancel the current routine and return to the spreadsheet. When used in the rapid-entry mode, the clear key cancels the current routine and updates the spreadsheet for all previous entries made in this mode.

The rapid-entry mode works when you enter data or use the calculator routine. Hit any arrow key instead of the enter key to make another entry without recalculating all the affected cells.

The contents of the cell at the cursor position appear on the cell status line as you make an entry. To recalculate the spreadsheet after an entry, hit the enter key.

Pressing the clear key or executing any command except Alpha, Value, or Calculator (described below) exits the rapid-entry mode and recalculates the spreadsheet. The program also exits the mode if the cursor scrolls to a column or row that's off-screen.

Labeling Cells

You use the Alpha command (A) to label a cell. When you invoke this command, the cell status line displays a lowercase (a) at the top of the screen and in the cell. However, this simply serves as an indicator; you still have all 12 character spaces available for entering text.

Type in your entry at the prompt and press the enter key to update the spreadsheet or the clear key to cancel the entry.

You can enter any combination of alphanumeric characters as a label ex-

cept an open parenthesis or quotation marks. NovaCalc's value interpretation routine uses an open parenthesis to detect alpha entries. Basic uses quotation marks as delimiters when separating and storing string variables, and NovaCalc saves all variables as strings.

You can't combine cells with label entries in mathematical functions, but you can use label cells in a column or row without affecting the total. The program's value interpretation routine sets the value of any alpha or blank cell to zero.

Blanking Out Cells

Blank (B) deletes the contents of a cell. It erases cell formulas and values and updates the spreadsheet.

If the cell you're blanking out derives from a formula in another cell, that formula remains unaffected, but the value of the blanked cell equals zero.

Copying Values

The Copy command (C) copies a cell's value to other cells so you don't have to reenter information. Copy can also link cells so that NovaCalc updates them whenever the source cell changes.

To link cells, type Y at the link prompt, or type N to copy without linking. Once linked, the destination cells contain a value like A01C, for example. A01 represents the source cell and C instructs the value interpretation routine to get the spreadsheet value from the source cell.

Command	Description
Alpha	Alpha command for entering label data
Blank	Blank command clears cell and deletes formula used to create it
Copy	Copy command copies value of one cell to another cell
Delete	Delete command erases cell formula while retaining cell's value
Go To	GOTO command positions cursor at specified cell location
Help	Help command displays explanations for all NovaCalc commands
Load	Load command loads saved spreadsheets
Print	Prints out the portion of the spreadsheet on the screen
Quit	Quit command ends session and prompts you to save data
Replicate	Replicate command projects and modifies over a series of cells
Save	Save command saves data to disk
Value	Value command for entering formulas and values
Calculate (=)	Activates four-function calculator

Table 1. Commands for NovaCalc.

You can't link alpha cells; the program unlinks any cell containing an alpha value prior to copying it to a new location.

The next prompt asks you if you want the cell copied to another cell location (C), or copied several locations down (D) or right (R).

The C option displays the current cursor location followed by an equals sign. You enter the target location. For example, entering A02 at this prompt copies the current cell to the second row of column A and updates the spreadsheet.

When you copy down or right, the program asks you how many times you want to copy the cell. Enter a number and hit the enter key. The program copies the value of the current cell location down or right the specified number of times and updates the screen.

Deleting Formulas

Delete (D) erases the formula used to calculate a cell without removing the cell's current value. It's useful for unlinking cells created with the Copy command. Press the D key to delete the formula and update the spreadsheet.

The GOTO Command

The GOTO command (G) lets you move the cursor to any cell by entering its location. This saves moving through the spreadsheet with the arrow keys. GOTO is especially useful when you want to move to a cell that's off-screen, or when you want to print a specific area of the spreadsheet.

GOTO prompts you for a cell location, then makes that location the upper left-hand cell on the display. For example, typing H, 1, and 7 resets the display to show columns H, I, J, and K and rows 17-29. If the cell specified is too far down to display a full screen, Nova-

Calc doesn't print the cell in the upper left-hand corner; instead, it marks the position with the cursor and displays a full screen.

Press the clear key to cancel GOTO and recalculate the spreadsheet. If you specify a cell location outside the limits of the spreadsheet, the program displays an "Entry Error" message and stays at the current cell location.

The Help Command

The Help command (H) lists NovaCalc's commands and gives you a short definition of each. Press the clear key to return to the spreadsheet.

Loading a Spreadsheet

To load files from disk, press the L key. Enter the appropriate file number (1-9) at the prompt. The message "Loading" appears on the screen as the file loads.

When the program finishes loading, it recalculates the spreadsheet and resets the cursor position to cell A01.

NovaCalc saves spreadsheet cells in an order dependent on the number of rows and columns. Before loading a file, be sure to choose the appropriate spreadsheet format. Otherwise, cells can reference formulas that don't exist.

Printing Spreadsheets

The Print command (P) prints out the portion of the spreadsheet on the display (four rows and 13 columns). You can print the values or the formulas.

Print prompts you to hit the enter key when the printer is ready. To cancel the Print command, press the clear key.

The program next asks you to press the D key to print display values, or the F key to print formulas. Press the appropriate key and hit the enter key. The program displays a "Printing" message and prints the spreadsheet.

Ending a Session

To end a session or restart the program, press the Q key. Quit prompts you to save data before ending the session.

The program then branches to the Save routine or prompts you to return to the spreadsheet (R), create a new spreadsheet (C), or exit to Basic ready (E).

The Replicate Command

The Replicate command projects and modifies a formula over a series of cells. This saves you from entering similar formulas in contiguous cells. Replicate works down or to the right.

For example, assume columns A, B, and C are labeled Income, Expenses, and Remaining Amount, and the formula for cell C01 is $C01 = A01 - B01$. If rows 1-12 represent January through December, and you want the same formula for each month, you must type $C02 = A02 - B02$, $C03 = A03 - B03$, and so on.

To do this automatically, type in R to enter the Replicate routine, then type D at the prompt for down, and 11 at the prompt for the number of times you want to replicate the formula.

If the number of rows or columns specified exceeds the number of remaining rows or columns in the spreadsheet, the program adjusts your entry before executing the command.

To replicate a formula to all remaining cells, enter any number exceeding the number of columns or rows in the spreadsheet. Press the clear key to cancel Replicate.

Saving Spreadsheets

The Save command (S) lets you save up to nine spreadsheet templates and data. The routine prompts you to save the file to a number from 1-9. Select a number or press the clear key to return to the command prompt.

NovaCalc displays a "Saving" message as it saves the spreadsheet to disk, then prompts you to return to the spreadsheet (R), create a new spreadsheet (N), or exit the program (E).

The Value Command

The Value command lets you enter numeric values or formulas. To make an entry, press the V key, type in the

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numeric value or formula and hit the enter key.

NovaCalc accepts any positive or negative number value as numeric input. Input numeric values requiring a mathematical operator with the Calculator routine.

To input a numeric value, type in the value and hit any arrow key to continue or the enter key to recalculate.

NovaCalc formulas add, subtract, multiply, or divide two cells or a cell and a numeric value. To build a formula, move the cursor to the cell where you want the result to appear. The cell location appears at the screen top in the format A01=.

Type in a cell location, a mathematical operator, and a numeric value, or a cell location. Now hit the enter key and the program calculates the value and puts it in the cell.

NovaCalc retains the formula used to calculate the cell and displays it on the cell status line when you position the cursor at the cell. The program updates the display for formula changes when it recalculates the spreadsheet.

In addition to the four mathematical operators listed above, NovaCalc also totals (T) or averages (A) a series of cells (see Table 2 for a list of mathematical functions).

To total a series of cells in the same

column or row, enter a starting cell location, press the T key, enter an ending cell location, and hit the enter key.

The program adds the contents of the cell locations from the starting cell to the ending cell and puts the result at the cursor location.

To average a series of cells in the same column or row, enter a starting cell location, type A, enter an ending cell location, and hit the enter key.

NovaCalc averages all cells from the first to the second location and displays the results at the cursor location.

Using the Calculator Function

The Calculator command adds, subtracts, multiplies, and divides values. To use it, hit the equals key. The routine displays the prompt START WITH <C>ELL VALUE X OR <Z>ERO?

Press the C key to use the current cell value as the starting subtotal. Press the Z key to start with a subtotal of zero.

Calculator displays the message SUBTOTAL=X, where X is the value you specified above, and the prompt ENTER VALUE:.

Type in a value and press the appropriate mathematical function (+, -, *, or /). Calculator performs the function on the value to create a new subtotal, and displays it at the screen top.

With a starting subtotal of zero, typing 1, 2, 3, and a plus sign adds 123 to zero for a new subtotal of 123 (the program ignores instructions to divide by zero).

When you're finished, hit the equals key to set the cell value to the new subtotal, or hit the clear key to exit the routine.

To use the rapid-entry mode with the Calculator routine, press any arrow key instead of the equals key. This places the value of the subtotal in the cell, but does not update the rest of the worksheet.

The Final Analysis

While NovaCalc is a full-featured spreadsheet, it lacks the speed of commercial programs. Occasionally, NovaCalc must do a dynamic string allocation. When this happens, the computer goes through memory to clean out the old variables and appears to hang up for several minutes.

However, this is a minor inconvenience when weighed against the cost of commercial spreadsheet programs. If it means saving \$100 or more, most home applications can probably wait a few minutes for the same results. ■

Contact Daniel D. Garms at P.O. Box 3742, Reston, VA 22090.

Mathematical Operator	Definition
A	Averages a series of cells in the same column or row
T	Totals a series of cells in the same column or row
+	Adds second entry to first entry
-	Subtracts second entry from first entry
*	Multiplies first entry by second entry
/	Divides first entry by second entry

Table 2. Mathematical operators for NovaCalc.

Program Listing. NovaCalc spreadsheet program.

```

10 CLS: CLEAR150: AS=STRING$(120,179): PRINT@0, AS: PRINT@267, "NovaCalc
  Financial Package Spreadsheet 1.0": PRINT@896, "Copyright 198
  3 by Daniel D. Garms": FOR D=1 TO 1500: NEXT: CLEAR10000: NS=STRING$(6
  4,32)
20 PRINT@896, "Set decimal precision to how many points? (1, 2, 3
  , or 4) ";
30 IS=INKEY$: IF IS=" " THEN 30 ELSE IF IS<"I" OR IS>"4" THEN 30
40 N=VAL(IS): PRINTN: TS=STRING$(N,40): IS="1": TS=IS+TS: N=VAL(TS)
50 PRINT@395, "Format spreadsheet as: ": PRINT: PRINT, "1. 24 column
  s by 26 rows": PRINT, "2. 16 columns by 39 rows": PRINT, "3. 12 co
  lumns by 52 rows": PRINT, "4. 8 columns by 70 rows"
60 IS=INKEY$: IF IS=" " THEN 60 ELSE IF IS<"1" OR IS>"4" THEN 60
70 IF IS="1" THEN N=24 ELSE IF IS="2" THEN N=16 ELSE IF IS="3" THEN N=12 ELSE
  IF IS="4" THEN N=8
80 U=624/N: DIM BS(U,N): DIM DS(U,H): AS="FILE T": CLS
90 REM SCREEN SETUP
100 B=197: I=1: J=1: K=1: L=1: E=0
110 CLS
120 C=J: R=I: PRINT@0, NS: NS=STRING$(4,143): CHR$(191): STRING$(6,143
  ): " ": CHR$(J+64): " ": STRING$(11,143): " ": CHR$(J+65): " ": STRING$(
  11,143): " ": CHR$(J+66): " ": STRING$(11,143): " ": CHR$(J+67): " ": ST
  RING$(6,143): CHR$(191): CNR$(32):
130 RS=STR$(R): RS=RIGHT$(RS,2): IFR>9 THEN 150
140 RS=RIGHT$(RS,1): TS="0": RS=TS+RS
150 PRINTCHR$(32): RS: CHR$(32): CHR$(191): STRING$(57,32): CHR$(191)
  :
160 R=R+1: IFR=I+13 THEN 100
170 PRINTCHR$(32): : GOTO 130
180 REM PRINT CELLS
190 DNERRORGOTO 2740: PRINT@0, NS: PRINT@0, "NovaCalc Spreadsheet ";
  AS: " (Press </> for commands)":
200 PRINT@64, NS: PRINT@64, " * * * CALCULATING * * * ": C=J: R=I: P=1
  98
210 PRINT@P, CHR$(32): VS=MID$(BS(R,C),1,1): IF VS=">" THEN A=ANDV$(CHR$(H
  +65)) THEN 290 ELSE IF VS="<" THEN A=ANDV$(CHR$(H+65)) THEN 250 ELSE IF VS="+" THEN 230 ELSE
  IF VS="-" THEN 240 ELSE IF VS="*" THEN 220 ELSE IF VS="/" THEN 270 ELSE 200
220 DS(R,C)="": GOTO 630
230 F#=0: TS=MID$(BS(R,C),2): S#=VAL(TS): GOTO 350
240 F#=0: TS=MID$(BS(R,C),2): S#=VAL(TS): GOTO 360
250 F=VAL(BS(R,C)): S=VAL(VS): IF F<STHEN 200
260 F#=0: S#=VAL(BS(R,C)): GOTO 350

```

Listing continued

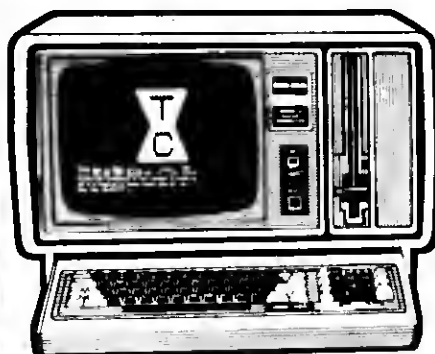
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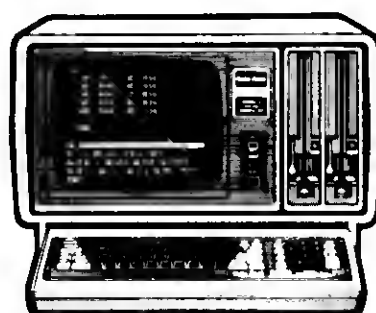
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Listing continued

```

270 D$(R,C)=MID$(B$(R,C),4):GOTO630
280 D$(R,C)="ENTRY ERROR ":GOTO630
290 T=LEN(B$(R,C)):IPT<4THEN280
300 W$=MID$(B$(R,C),2,2):X$=MID$(B$(R,C),4,1):V=ASC(V$)-64:W=VAL(W$):IFV>HORW>THEN280ELSEF$=VAL(D$(W,V)):IFX$="C"THEN480
310 Y$=MID$(B$(R,C),5,1):IFY$<"0"DRY$>"9"THEN338
320 T=VAL(Y$):Y$=MID$(B$(R,C),5):S$=VAL(Y$):IFS$<TTHEN280ELSE340
330 Z$=MID$(B$(R,C),6,2):Y=ASC(Y$)-64:Z=VAL(Z$):IFY>HORZ>THEN280ELSESE$=VAL(D$(Z,Y))
340 IFX$="+"THEN350ELSEIFX$="-"THEN360ELSEIFX$="*"THEN370ELSEIFX$="/"THEN380ELSEIFX$="A"THEN410ELSEIFX$="T"THEN420ELSE280
350 T$=F$+S$:GOTO550
360 T$=F$-S$:GOTO550
370 T$=F$*S$:GOTO550
380 IFS$=0THEN280
390 T$=F$/S$:GOTO550
400 T$=F$:GOTO550
410 D=1
420 IFV=YTHEN490
430 F$=VAL(D$(W,V))
440 V=V+1:S$=VAL(D$(W,V))
450 T$=F$+S$:D=D+1:IFV=YTHEN470
460 F$=T$:GOTO440
470 IFX$="T"THEN550
480 T$=T$/D:GOTO550
490 F$=VAL(D$(W,V))
500 W=W+1:S$=VAL(D$(W,V))
510 T$=F$+S$:D=D+1:IFW=ZTHEN530
520 F$=T$:GOTO500
530 IFX$="T"THEN550
540 T$=T$/D
550 IFI$>0THEN570
560 T$=T$*H:T$=T$-.5:T$=FIX(T$):GOTO580
570 T$=T$*H:T$=T$+.5:T$=FIX(T$):
580 QS=STR$(N):Q=LEN(QS)-2:P$="":T$=STR$(T$):F$=RIGHT$(T$,Q):F=LEN(T$):IFF=QTHENF=Q+1
590 T$=LEFT$(T$,F-Q):P=VAL(F$):F$=STR$(P):F$=MID$(F$,2)
600 F=LEN(F$):IFF=QTHEN620
610 S$=STRING$(Q-F,40):F$=S$+F$
620 T$=T$+P$+F$:D$(R,C)=T$
630 F=LEN(D$(R,C)):IFF>12THEN650
640 F=12-F:IFV$="("THEN670ELSE660
650 D$(R,C)=LEFT$(D$(R,C),12):F=0:PRINT@P,"%";
660 PRINT$TRING$(F,32);D$(R,C):GOTO680
670 PRINTD$(R,C);STRING$(F,32);
680 R=R+1:IFR=I+13THEN780
690 P=P+64:GOTO210
700 R=I:P=P-754:C=C+1:IFC=J+4THEN710ELSE210
710 IFE=1THEN720ELSE730
720 I=I+13:D=D+1:GOTO1900
730 REMCURSORCONTROL
740 C=L:R=R:R$=STR$(R):R$=RIGHT$(R$,2):IFR>9THEN750ELSER$=RIGHT$(R$,1):T$="0":R$=T$+R$
750 PRINT@B,CHR$(103);:PRINT@B+14,CHR$(107);
760 L$=CHR$(C+64):T$="":L$=L$+R$+T$:PRINT@64,N$;:PRINT@64,L$;B$(R,C);
770 I$=I$KEYS
780 IFI$=" "THEN770ELSEIFI$=CHR$(13)THEN770ELSEIFI$=CHR$(34)THEN770ELSEIFI$=CHR$(31)THEN190ELSEIFI$=CHR$(91)THEN790ELSEIFI$=CHR$(10)THEN840ELSEIFI$=CHR$(0)THEN890ELSEIFI$=CHR$(9)THEN940ELSEIFI$="/"THEN990ELSE770
790 PRINT@B,CHR$(32);:PRINT@B+14,CHR$(32);:K=K-1:IFK<1THENK=1ELSE810
800 PRINT@B,CHR$(103);:PRINT@B+14,CHR$(107);:GOTO770
810 IFK<1THEN830
820 B=B-64:GOTO740
830 I=I-1:GOTO120
840 PRINT@B,CHR$(32);:PRINT@B+14,CHR$(32);:K=K+1:IFK>UTHENK=K-1ELSE860
850 PRINT@B,CHR$(103);:PRINT@B+14,CHR$(107);:GOTO770
860 IFK=I+13THEN880
870 B=B+64:GOTO740
880 I=I+1:GOTO120
890 PRINT@B,CHR$(32);:PRINT@B+14,CHR$(32);:L=L-1:IFL<1THEHL=1ELSE910
900 PRINT@B,CHR$(103);:PRINT@B+14,CHR$(107);:GOTO770
910 IPL<JTHEN930
920 B=B-14:GOTO740
930 J=J-1:GOTO120
940 PRINT@B,CHR$(32);:PRINT@B+14,CHR$(32);:L=L+1:IFL>HTHENL=L-1ELSE960
950 PRINT@B,CHR$(103);:PRINT@B+14,CHR$(107);:GOTO770
960 IFL=J+4THEN980

```

Listing continued

```

970 B=B+14:GOTO740
980 J=J+1:GOTO120
990 REMCOMMANDE
1000 PRINT@64,"Alpha Blank Copy Del Goto Help Load Print Quit Re
pli Save Val =";
1010 IS=INKEY$:IFIS=""THEN1010ELSEIFIS=CHR$(31)THEN740ELSEIFIS="
A"THEN1030ELSEIFIS="B"THEN1050ELSEIFIS="C"THEN1070ELSEIFIS="G"TH
EN1470ELSEIFIS="H"THEN1600ELSEIFIS="L"THEN1670ELSEIFIS="P"THEN10
50ELSEIFIS="Q"THEN2020ELSEIFIS=1020
1020 IFIS="D"THEN1420ELSEIFIS="R"THEN2240ELSEIFIS="S"THEN2050ELS
EIFIS="V"THEN2520ELSEIFIS=""THEN2500ELSEIFIS=10
1030 RENALFNA
1040 TS="(a)";PRINT@0,N$;N$;:PRINT@0,"Type entry then depress <E
NTER>";:PRINT@64,L$;T$;:GOTO2540
1050 REMBLANK
1060 B$(R,C)="" :GOTO200
1070 REMCOPY
1080 PRINT@0,N$;N$;:PRINT@0,"Link cells? <Y>es or <N>o";
1090 IS=INKEY$:IFIS=""THEN1090ELSEIFIS=CHR$(31)THEN190ELSEIFIS="
Y"THENE=0ELSEIFIS="N"THENE=2ELSEIFIS=0
1100 PRINT@0,STRINGS(120,32);:PRINT@0,"Copy <C>ell, <O>wn, or <
R>ight?";
1110 IS=INKEY$:IFIS=""THEN1110ELSEIFIS="C"THEN1320ELSEIFIS="D"TH
EN1120ELSEIFIS="R"THEN1220ELSEIFIS=CHR$(31)THEN190ELSEIFIS=110
1120 PRINT@64,"Type number of rows to copy down then <ENTER> ";:
TS="" :FS=LEFT$(L$,3) :SS="C" :FS=FS+SS :IFB$(R,C)=""THENFS=""
1130 IS=INKEY$:IFIS=""THEN1130ELSEIFIS=CHR$(31)THEN190ELSEIFIS="
0"ANOIS=<"9"THEN1140ELSEIFIS=CNR$(13)THEN1150ELSEIFIS=130
1140 PRINTIS;:TS=TS+IS:GOTO1130
1150 F=R+1:S=VAL(TS):T=R+S:IFT>UTHENT=U
1160 IFLEFT$(B$(R,C),1)=""("THEN1170ELSEIFIS=110
1170 E=0:FORD=FTOT:B$(O,C)=B$(R,C):NEXT:GOTO190
1180 IFE=0THEN1210
1190 E=0:F=VAL(D$(R,C)):FS=STR$(F):IFF#<0THEN1210
1200 FS=MID$(FS,2)
1210 FORD=FTOT:B$(O,C)=FS:NEXT:GOTO190
1220 PRINT@64,"Type number of columns to copy right then <ENTER>
";:TS="" :FS=LEFT$(L$,3) :SS="C" :FS=FS+SS :IFB$(R,C)=""TRENFS=""
1230 IS=INKEY$:IFIS=""THEN1230ELSEIFIS=CHR$(31)THEN190ELSEIFIS="
0"ANOIS=<"9"THEN1240ELSEIFIS=CHR$(13)THEN1250ELSEIFIS=1230
1240 PRINTIS;:TS=TS+IS:GOTO1230
1250 F=C+1:S=VAL(TS):T=S+C:IFT>HHTENT=H
1260 IFLEFT$(B$(R,C),1)=""("THEN1270ELSEIFIS=1200
1270 E=0:FORD=FTOT:B$(R,D)=B$(R,C):NEXT:GOTO190
1280 IFE=0THEN1310
1290 E=0:F=VAL(D$(R,C)):FS=STR$(F):IFF#<0THEN1310
1300 FS=MID$(FS,2)
1310 FORD=FTOT:B$(R,O)=FS:NEXT:GOTO190
1320 SS=LEFT$(L$,3) :FS="C" :FS=SS+FS:PRINT@64,"Copy ";SS;" to ";:
SS=""
1330 IS=INKEY$:IFIS=""THEN1330ELSEIFIS=CHR$(31)THEN190ELSEIFIS<"
A"ORIS>CNR$(N+64)THEN1330ELSEIFIS=IS
1340 PRINTIS;
1350 IS=INKEY$:IFIS=""THEN1350ELSEIFIS=CHR$(31)THEN190ELSEIFIS<"
0"ORIS>"9"THEN1350
1360 PRINTIS;:SS=SS+IS:T=LEN(SS):IFT<2THEN1350
1370 F=ASC(TS)-64:S=VAL(SS)
1380 IFLEFT$(B$(R,C),1)=""("THEN1410
1390 IFE=2THEN1410
1400 B$(S,F)=FS:GOTO190
1410 E=0:B$(S,F)=B$(R,C):GOTO190
1420 REMDELETE
1430 FS=LEFT$(B$(R,C),1):IFFS=""("THEN190
1440 F=VAL(D$(R,C)):FS=STR$(F):IFF#<0THEN1460
1450 FS=MID$(FS,2)
1460 B$(R,C)=FS:GOTO190
1470 REMGOTO
1480 PRINT@0,N$;N$;:PRINT@0,"Go to which cell? ";
1490 IS=INKEY$:IFIS=""THEN1490ELSEIFIS=CHR$(31)THEN190ELSEIFIS<"
A"ORIS>CHR$(H+64)THEN1490ELSEIFIS=IS:SS=""
1500 PRINTIS;
1510 IS=INKEY$:IFIS=""THEN1510ELSEIFIS=CHR$(31)THEN190ELSEIFIS<"
0"ORIS>"9"THEN1510
1520 PRINTIS;:SS=SS+IS:T=LEN(SS):IFT<2THEN1510
1530 S=VAL(SS):IFS>UTHENT2740
1540 J=ASC(FS)-64:L=J:C=L:F=0:IFJ>R-3THEN1550ELSEIFIS=1560
1550 J=H-3:F=H-L:F=F+14:F=42-F
1560 R=VAL(SS):IFR>UTHENT2740
1570 IFR>U-12THEN1590
1580 I=R:K=R:B=197:B=B+F:GOTO120
1590 I=R/13+.95:I=FIX(I):I=I*13-12:T=(R-I)*64:B=T+197+F:K=R:GOTO
120
1600 REMHELP

```

Listing continued



MacInker

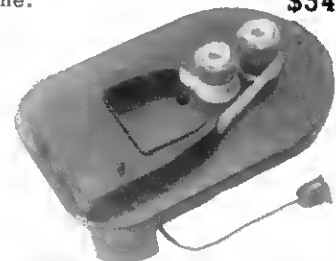
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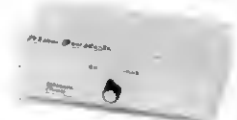
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Listing continued

```

1610 CLS:PRINT" * * * HELP ON COMMANDS * * *":PRINT"<A>Alpha allow
s cell to contain a non-numeric/formula value":PRINT"<B>Blank cle
ars cell and deletes any formula used to create it":PRINT"<C>Copy
makes cell equal to value of a specified cell"
1620 PRINT"<D>el(ete) formula used to calculate cell but retain
value"
1630 PRINT"<G>oto positions cell pointer (cursor) at specified c
ell":PRINT"<L>oads a previously saved file (designated files 1 t
hru 9)":PRINT"<P>rints a copy of all rows of displayed columns"
1640 PRINT"<Q>uit ends session giving option to save data to one
of 9 files<R>ep(icate) projects/modifies a formula over a seri
es of cells<S>ave data to one of 9 files":PRINT"<V>al(ue) estab
lishes contents of a cell through keyboard input"
1650 PRINT"<CLEAR> cancels command/action and returns to spreads
heet":PRINT"<=> Accessee built-in five function calculator":PRIN
T:PRINT" * * * DEPRESS <CLEAR> TO RETURN TO WORKSHEET * * *
";
1660 IS=INKEY$:IFIS=""THEN1660ELSEIFIS=CHR$(31)THEN110ELSE1660
1670 REMLOAD
1680 PRINT@,NS;NS;:PRINT@,"LOAD WHICH FILE? (1-9) ";
1690 IS=INKEY$:IFIS=""THEN1690ELSEIFIS=CHR$(31)THEN190ELSEIFIS<"
0">ORIS>"9"THEN1690
1700 C=1:R=1:AS=LEFT$(AS,5):AS=AS+IS
1710 PRINT@64,"LOADING ";AS;" -- PLEASE WAIT";:IFIS="1"THEN1720E
LSEIFIS="2"THEN1730ELSEIFIS="3"THEN1740ELSEIFIS="4"THEN1750ELSEI
FIS="5"THEN1760ELSEIFIS="6"THEN1770ELSEIFIS="7"THEN1780ELSEIFIS=
"8"THEN1790ELSEIFIS="9"THEN1800
1720 CLOSE:OPEN"1",2,"FILE1":GOTO1810
1730 CLOSE:OPEN"1",2,"FILE2":GOTO1810
1740 CLOSE:OPEN"1",2,"FILE3":GOTO1810
1750 CLOSE:OPEN"1",2,"FILE4":GOTO1810
1760 CLOSE:OPEN"1",2,"FILE5":GOTO1810
1770 CLOSE:OPEN"1",2,"FILE6":GOTO1810
1780 CLOSE:OPEN"1",2,"FILE7":GOTO1810
1790 CLOSE:OPEN"1",2,"FILE8":GOTO1810
1800 CLOSE:OPEN"1",2,"FILE9":GOTO1810
1810 INPUT#2,H$(R,C)
1820 C=C+1:IFC=<RTHEN1810
1830 C=1:R=R+1:IFR=<UTHEN1810
1840 CLOSE:GOTO1800
1850 REMPRINT
1860 PRINT@,NS;NS;:PRINT@,"READY PRINTER -- Press <ENTER> or <
CLEAR> to cancel";
1870 IS=INKEY$:IFIS=""THEN1870ELSEIFIS=CHR$(31)THEN190ELSEIFIS=C
HR$(13)THEN1800ELSE1870
1880 PRINT@64,"Print <D>isplayed values or <F>ormulas?";:IS=INKE
Y$:IFIS=""THEN1880ELSEIFIS="D"THEN1890ELSEIFIS="F"THEN1920ELSEIF
IS=CHR$(31)THEN190ELSE1880
1890 D=1:G=U/13:M=I:I=1:E=1
1900 IFD>GTEN1910ELSE120
1910 E=0:I=M
1920 PRINT@64,NS;:PRINT@64,"PRINTING -- PLEASE WAIT";
1930 S$=" "
R=1:C=J:LPRINTSTRING$(10,35); " ";CHR$(C+6
4); " ";STRING$(12,35); " ";CHR$(C+65); " ";STRING$(12,35); " ";CHR$
(C+66); " ";STRING$(12,35); " ";CHR$(C+67); " ";STRING$(7,35)
1940 R$=STR$(R):T=LEN(R$):T=3-T
1950 LPRINTSTRING$(T,32);R$;" * ";
1960 IFIS="D"THEN1900
1970 LPRINTUSINGSS;S$(R,C);:LPRINT" * ";:GOTO1990
1980 LPRINTUSINGSS;S$(R,C);:LPRINT" * ";
1990 C=C+1:IFC<J+4THEN1960
2000 LPRINT:R=R+1:C=J:IFR=<UTHEN1940
2010 LPRINTSTRING$(65,35):R=K:C=L:GOTO120
2020 REMQUIT
2030 PRINT@,NS;NS;:PRINT@,"SAVE CONTENTS -- Depress <Y>es to s
ave or <N>o";
2040 IS=INKEY$:IFIS=""THEN2040ELSEIFIS=CHR$(31)THEN190ELSEIFIS="
Y"THEN2050ELSEIFIS="N"THEN2230ELSE2040
2050 PRINT@,NS;NS;:PRINT@,"Save as which file? (1-9)";
2060 IS=INKEY$:IFIS=""THEN2060ELSEIFIS=CHR$(31)THEN190ELSEIFIS>"
0">ANDIS<"9"THEN2070ELSE2060
2070 C=1:R=1:AS=LEFT$(AS,5):AS=AS+IS
2080 PRINT@64,"SAVING AS ";AS;" -- PLEASE WAIT";:IFIS="1"THEN209
0ELSEIFIS="2"THEN2100ELSEIFIS="3"THEN2110ELSEIFIS="4"THEN2120ELS
EIFIS="5"THEN2130ELSEIFIS="6"THEN2140ELSEIFIS="7"THEN2150ELSEIFI
S="8"THEN2160ELSEIFIS="9"THEN2170
2090 CLOSE:OPEN"O",1,"FILE1":GOTO2180
2100 CLOSE:OPEN"O",1,"FILE2":GOTO2180
2110 CLOSE:OPEN"O",1,"FILE3":GOTO2180
2120 CLOSE:OPEN"O",1,"FILE4":GOTO2180
2130 CLOSE:OPEN"O",1,"FILE5":GOTO2180
2140 CLOSE:OPEN"O",1,"FILE6":GOTO2180
2150 CLOSE:OPEN"O",1,"FILE7":GOTO2180

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Listing continued

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2160 CLOSE:OPEN"D",1,"FILE8":GOTO2180
2170 CLOSE:OPEN"O",1,"FILE9"
2180 PRINT#1,CHR$(34);B$(R,C);CHR$(34);
2190 C=C+1:IFC=<BTHEN2180
2200 C=1:R=R+1:IFR=<UTHEN2180
2210 PRINT#64,"<R>return to spreadsheet or <N>ew spreadsheet or <
E>xit program?";
2220 IS=INKEY$:IFIS=""THEN2220ELSEIFIS="R"THEN190ELSEIFIS="N"THE
N10ELSEIFIS="E"THEN2230ELSE2220
2230 CLOSE:CMD" ":CLS:END
2240 REMREPLICATE
2250 V$=LEFT$(B$(R,C),1):IFV$<"A"ORV$>CHR$(U+64)THEN2740
2260 PRINT#0,N$;N$;PRINT#0,"Replicate formula <D>own or <R>ight
? ";
2270 IS=INKEY$:IFIS=""THEN2270ELSEIFIS=CHR$(31)THEN190ELSEIFIS="
D"THEN2280ELSEIFIS="R"THEN2420ELSE2270
2280 PRINT#0;PRINT#64,"Type number of rows to replicate down th
en <ENTER> ";T$=""
2290 IS=INKEY$:IFIS=""THEN2290ELSEIFIS=CHR$(31)THEN190ELSEIFIS="C
HR$(13)THEN2310ELSEIFIS="0"ANDIS=<"9"THEN2300ELSE2290
2300 PRINT#0;T$=T$+IS:GOTO2290
2310 S$="0":F=R:S=VAL(T$):S=S+R:IFS>UTHENS=U
2320 V$=LEFT$(B$(F,C),1):W$=MID$(B$(F,C),2,2):W=VAL(W$):X$=MID$(
B$(F,C),4,1):W=W+1:IFW>UTHEN2740
2330 N$=STR$(W):IFW>9THEN2350
2340 W$=RIGHT$(W$,1):W$=S$+W$
2350 W$=RIGHT$(W$,2):F$=V$+W$+X$:Y$=MID$(B$(F,C),5,1):IFY$>"A"
NDY$<CHR$(U+65)THEN2370ELSEIFY$=""THEN2410
2360 Y$=MID$(B$(F,C),5):F$=F$+Y$:GOTO2410
2370 Z$=MID$(B$(F,C),6,2):Z=VAL(Z$):Z=Z+1:IFZ>UTHEN2740
2380 Z$=STR$(Z):IFZ>9THEN2400
2390 Z$=RIGHT$(Z$,1):Z$=S$+Z$
2400 Z$=RIGHT$(Z$,2):F$=F$+Z$+Z$
2410 F=F+1:B$(F,C)=F$:IFF=STHEN190ELSE2320
2420 PRINT#0;PRINT#64,"Type number of columns to replicate righ
t then <ENTER> ";T$=""
2430 IS=INKEY$:IFIS=""THEN2430ELSEIFIS=CHR$(31)THEN190ELSEIFIS="C
HR$(13)THEN2450ELSEIFIS="0"ANDIS=<"9"THEN2440ELSE2430
2440 PRINT#0;T$=T$+IS:GOTO2430
2450 S$="0":F=C:S=VAL(T$):S=S+C:IFS>RTHENS=H
2460 V$=LEFT$(B$(R,F),1):V=ASC(V$)+1:W$=MID$(B$(R,F),2,2):X$=MID
$(B$(R,F),4,1):IFV=64>HTHEN2740
2470 F$=CHR$(V):F$=F$+W$+X$:Y$=MID$(B$(R,F),5,1):IFY$>"A"ANDY$=
<CHR$(H+65)THEN2490ELSEIFY$=""THEN2510
2480 Y$=MID$(B$(R,F),5):F$=F$+Y$:GOTO2510
2490 Z$=MID$(B$(R,F),6,2):Y=ASC(Y$)+1:IFY=64>HTHEN2740
2500 Y$=CHR$(Y):F$=F$+Y$+Z$
2510 F=F+1:B$(R,F)=F$:IFF=STHEN190ELSE2460
2520 REMVALUE
2530 PRINT#0,N$;N$;PRINT#0,"Type value or formula then depress
<ENTER> ";PRINT#64,L$;T$=""
2540 IS=INKEY$:IFIS=""THEN2540ELSEIFIS=CHR$(13)THEN2560ELSEIFIS=
CHR$(31)THEN190ELSEIFIS=CHR$(34)THEN2540ELSEIFIS=CHR$(91)DRIS>CH
R$(7)ANDIS<CHR$(11)THEN2730
2550 T$=T$+IS:PRINT#0;GOTO2540
2560 B$(R,C)=T$:GOTO190
2570 REM(=) CALCULATOR
2580 T$=VAL(B$(R,C)):PRINT#0,N$;N$;PRINT#0,"Start with <C>ell v
alue (" ;T$;" ) or <D>ero?"
2590 IS=INKEY$:IFIS=""THEN2590ELSEIFIS="C"THEN2620ELSEIFIS="Z"TH
EN2600ELSEIFIS=CHR$(31)THEN190ELSE2590
2600 T$=0:F#=0
2610 F$=""
2620 PRINT#0,N$;N$;PRINT#0,"SUBTOTAL = ";T$;PRINT#64,"ENTER VA
LUE: ";
2630 IS=INKEY$:IFIS=""THEN2630ELSEIFIS=CHR$(31)THEN190ELSEIFIS="
0"ANDIS=<"9"THEN2640ELSEIFIS="+"THEN2650ELSEIFIS="-"THEN2660ELS
EIFIS=""THEN2670ELSEIFIS="/"THEN2680ELSEIFIS=""THEN2700ELSE263
0
2640 PRINT#0;F$=F$+IS:GOTO2630
2650 F#=VAL(F$):T$=T$+F$:GOTO2610
2660 F#=VAL(F$):T$=T$-F$:GOTO2610
2670 F#=VAL(F$):T$=T$*F$:GOTO2610
2680 F#=VAL(F$):IFF#=0THEN2630
2690 T$=T$/F$:GOTO2610
2700 IFT#<0THEN2720
2710 F$=STR$(T$):B$(R,C)=MID$(F$,2):GOTO190
2720 B$(R,C)=STR$(T$):GOTO190
2730 B$(R,C)=T$:PRINT#0,"RAPID ENTRY (Press </> for commands <CL
EAR> updates)";PRINT#B+1,STRING$(13,32);PRINT#B+2,LEFT$(B$(R,C
),12);GOTO780
2740 PRINT#64,N$;PRINT#64," * * ENTRY ERROR * * ";FORD=1TO15
00:NEXT:GOTO190

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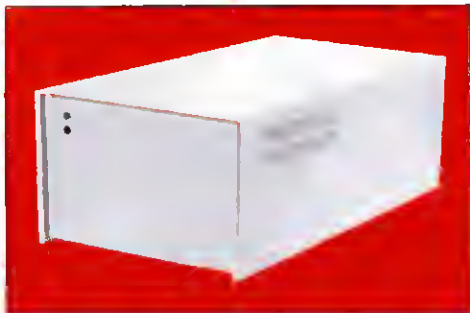
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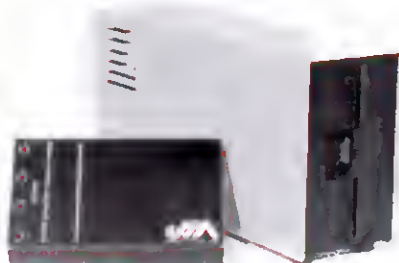
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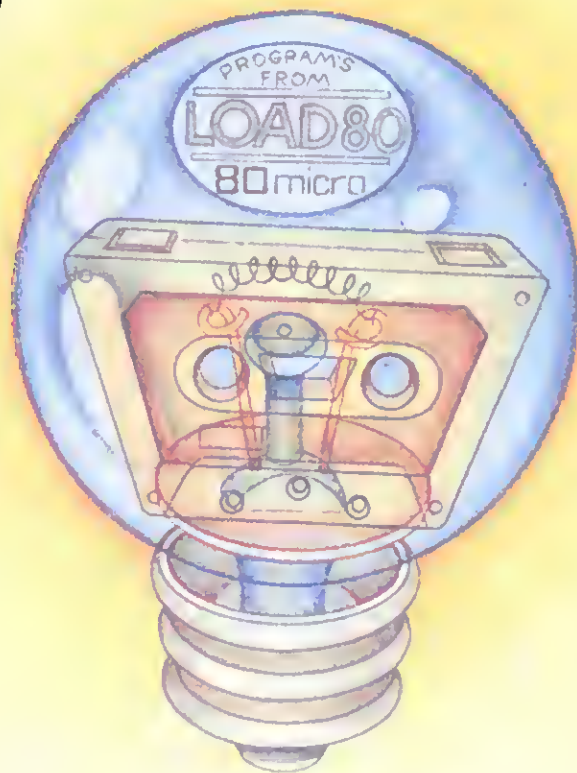
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Basic Concepts

Program Listing 1 prints out worksheets that let you design and map graphics characters of varying sizes (see Fig. 1). First type in, save, and run Listing 1. Once you start experimenting with your own graphics, you'll need a lot of these worksheets.

The seven numbers (1, 2, 4, 8, 16, 32, and 64) in the worksheet's left-hand column represent the seven controllable print-head wires that, when activated in a specific pattern, create a variety of graphics characters. The print-head pins are numbered this way so that you get a unique sum, in the range of 1-127, for any combination of pins. For example, while the sum of all seven numbers is 127, every combination of the numbers yields a different sum.

The following program prints each of the available TRS-80 graphics characters in a line without gaps. Because of this, you can develop custom graphics characters, made up of individual standard graphics characters, of any length. The CHR\$(30) in line 50 of the program below resets the printer, removing it from the graphics mode. Now, type in and run this program:

```
10 LPRINT CHR$(18) 'set printer to graphics
   mode
20 FOR I = 128 TO 255
30 LPRINT CHR$(I);
40 NEXT I
50 LPRINT CHR$(30) 'set printer to non-graph-
   ics mode
```

Figure 1. Worksheet and drawing.

Custom Printing

The graphics characters printed here probably look familiar, especially if you've ever shopped for a printer. Be more creative now and try your skill at customized graphics.

Using a soft lead pencil, put dots in each box of column A of the worksheet you created with Program Listing 1. In

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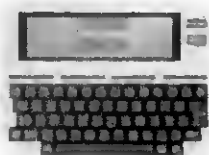
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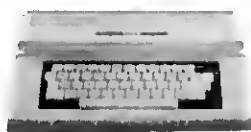
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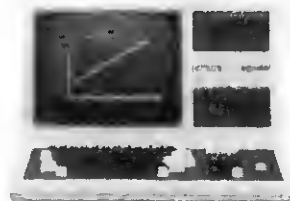
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----	----	----	----	---	-----	----	-----	---	---	----	---	---	---	-----	---

BOTTOM

3	31	34	76	34	30	4	4	4	4	30	34	76	34	30	7	0
---	----	----	----	----	----	---	---	---	---	----	----	----	----	----	---	---

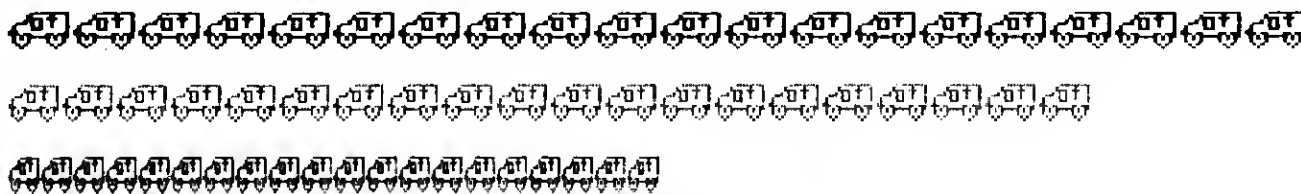


Figure 2. Printout of drawing in Figure 1.

Program Listing 1. Basic program to create worksheets.

```

100 ' GRAPH PAPER FOR CNARGEN/GS1 AND GS2
110 '   SAVED AT GRAPAPER/FRM
120 CLEAR1000
130 LPRINTCHR$(27);CNR$(20)'set to condensed mode
140 CLS
145 PRINT"SET PAPER IN PRINTER AT TOP OF NEW SHEET"
147 PRINT:PRINT"HIT ANY KEY TO START PRINTING"
150 IF INKEY$=""THEN 150
160 FOR FS=1TO3 ' loop to set number of forms
170 LPRINTSTRINGS(130,"")
175 GOSUB1000
180 B=0
190 FORI=1TO8
200 LPRINT" "
210 IFI<8THEN GOSUB290 ELSE GOSUB440
220 GOSUB390 'subroutine to put in pin numbers
230 GOSUB310 'lprint column seperating bar
240 NEXTI
250 LPRINT" "
260 LPRINTSTRINGS(130,"")
270 NEXT FS
280 END
290 LPRINTSTRINGS(130,"-")
300 RETURN
310 FORI3=1TO19
320 LPRINTTAB(10);
330 LPRINTCNR$(10); 'go into graphics mode
340 LPRINTCNR$(191); 'lprint graphic bar
350 LPRINTCNR$(30); 'come out of graphics mode
360 LPRINT" "; ' six blank spaces
370 NEXTI3
380 RETURN
390 'SUBROUTINE TO PUT IN NUMBERS
400 A=2[B
410 B=B+1
420 IFA>64 THENLPRINT"TOTALS";ELSELPRINTA;
430 RETURN
440 'SUBROUTINE TO PRINT TOTAL LINE
450 LPRINTSTRINGS(130,"")
460 RETURN
1000 CL=65
1005 LPRINTTAB(13);
1010 LPRINTCHR$(CL);
1015 LPRINT" ";
1020 IF CL=83 THEN 1050
1030 CL=CL+1
1040 GOTO1010
1050 RETURN

```

End

Program Listing 2. Basic program to enter one-line graphics.

```

100 '*****
110 '   CBARGEN/GS1
120 '*****
130 CLS
140 PRINT"USE GRAPAPER/FRM PROGRAM TO PLOT A SEQUENCE OF PIN FIRINGS"
150 PRINT"THEN ENTER THE TOTAL OF EACH COLUMN IN RESPONSE TO THE P
160 PRINT:PRINT"THE PROGRAM WILL ADD 128 TO EACH TOTAL TO GENERATE
    PRINTER"

```

Listing 2 continued

columns B-F put a dot in the top and bottom row only (pin numbers 1 and 64). In column G, put dots from top to bottom again. Now add the values of each column: 127 for A, 65 for B, 65 for C, 65 for D, 65 for E, 65 for F, and 127 for G.

When you run Program Listing 2, it prompts you to type in the totals for each column. After you enter the numbers, type in 999 to terminate data entry. Your printer should be on, and it will print the following: a tiny box, the pin firing codes (the column values), and a three-line series of the character in different font sizes (elongated, normal, and condensed).

Notice that all the boxes are connected; to print a series of individual boxes, enter a zero before typing in 999. Keep in mind that the program automatically adds 128 to the pin codes because the printer requires that all character codes be in a range of 128 to 255.

Try experimenting with different drawings or simply enter a series of numbers; for example, entering 10 numbers at intervals of 5 (don't forget to type 999) makes a nice line of graphics. This type of graphic can be used in a subroutine to separate reports, or as a more interesting alternative to asterisks.

Larger Graphics

Single line graphics are nice, but somewhat limited. Program Listing 3, while operating on the same concept as Program Listing 2, lets you print graphics that are twice as high. When mapping out the larger characters, split the character between two worksheets and calculate column totals for each. After tabulating the totals, run Program Listing 3, which, in turn, prompts you to enter these values.

Remember to enter zeros in the blank columns to guarantee alignment. The drawing in Fig. 1 and the corresponding

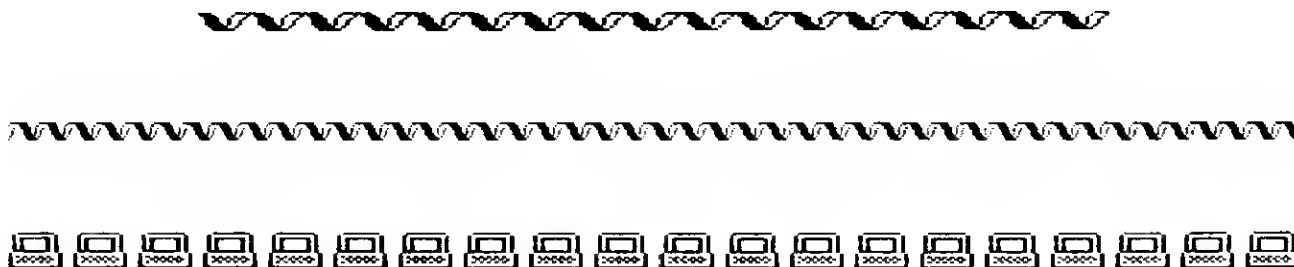


Figure 3. Graphics lines created by Program Listings 4 (top line), 5 and 6 (middle line), and 7 (bottom line).

*You can expand
this technique
to print graphics
for all purposes.*

printout in Fig. 2 are examples of this size character. (The subroutine in Program Listing 7 is also geared towards the larger graphics characters.)

The subroutines in Program Listings 4-7 illustrate the variety of ways to store and print graphics codes. Program Listing 4, for example, uses CHR\$ code links stored in strings to print a line of graphics characters. I used A\$ and A1\$ only because I didn't want to print off the page when listing the program. Your strings can be much longer if you choose.

Because this particular character is good only when printed in a line, I used a For...Next loop to fill the page from left to right. The string method used here is quite fast, especially when compared with the subroutines in Program Listings 5 and 6.

Program Listings 5 and 6 both use Read Data statements. While one is quicker than the other, they're both slow. I've included these because it's easier to change data statements in each graphics subroutine than to retype the CHR\$ codes. If time isn't critical, this method makes it easy to build a library of subroutines.

You can easily expand the technique discussed here to print graphics of all sizes for all purposes. Playing with combinations of column values is both fun and productive. Happy printing! ■

Write to Glen E. Sparks at 6186 Custer, S. Rockwood, MI 48179.

Listing 2 continued

```

170 PRINT"GRAPHICS IN A LINE USING EACH TO THE FONTS AVAILABLE TO
GRAPHICS"
180 PRINT"IT WILL ALSO PRINT OUT THE COLUMN TOTALS FOR REFERENCE."
185 PRINT:PRINT"TYPE 999 TO END INPUT"
190 PRINT:PRINT"HIT ANY KEY TO BEGIN"
200 PRINT:PRINT:PRINT
210 IF INKEY$="" THEN 210
220 CLS
230 CLEAR500
240 DIMN(50)
250 Z=1
260 '*****
270 ' INPUT CODES
280 '*****
290 CLS
300 I=1
305 CL=65
310 PRINT"PIN COLUMN ";CHR$(CL);" ";
315 INPUT N(I)
320 IFN(I)=999 THEN 370
330 IFN(I)>127 THENPRINT"TOO HIGH-MUST BE UNDER 127":GOTO310
350 I=I+1
355 CL=CL+1
360 GOTO310
370 '*****
380 ' SEND TO PRINTER
390 '*****
400 T=I
410 FORI=1TOT
415 IFN(I)=999 THEN N(I)=0
420 A$=CHR$(N(I)+120)
430 LPRINT CHR$(10);A$; ' put into graphics mode and lprint CHR$
440 NEXTI
450 LPRINTCHR$(30) 'set to non-graphic text
460 LPRINTCHR$(27);CHR$(20) 'set to condensed for code number prin
tout
470 FORI=1TO(T-1):LPRINTN(I);:LPRINT" ";
480 NEXTI
490 '*****
500 ' SEND LINE OF CUSTOM CBARACTERS TO PRINTER
510 ' SET CHARACTER FONT FOR LINE OF CUST. CHAR
520 '*****
530 CLS
540 IFZ>1THENLPRINTCHR$(27);CHR$(15) 'get out of Expanded mode
550 ONZ GOTO 590 ,610 ,630 ,650
560 LPRINT CHR$(27);CHR$(14) 'expanded mode
570 GOTO670
580 LPRINTCHR$(27);CHR$(19) 'normal characters
590 GOTO670
600 LPRINTCHR$(27);CHR$(20) 'condensed mode
610 GOTO670
620 RUN240
630 '*****
640 ' PRINTOUT OF CHAR REPEATED 20 TIMES
650 '*****
660 FORI=1TO20
670 FORI=1TO(T-1)
680 A$=CHR$(N(I)+120) 'add 120 to pin number to produce CHR$ code
690 LPRINTCHR$(10);A$; 'go into graphics mode and print char
700 NEXTI:NEXTI
710 LPRINTCHR$(30) 'get out of graphics mode
720 Z=Z+1
730 GOTO 570

```

End



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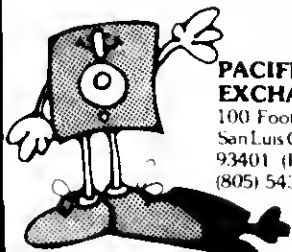
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Program Listing 3. Basic program to enter two-line graphics.

```

100 *****
110 ' CHARGEN/GS2
120 *****
130 CLS
140 PRINT"USE GRAPAPER/FRM PROGRAM TO PLOT A SEQUENCE OF PIN FIRIN
GS"
150 PRINT"THEN ENTER THE TOTAL OF EACH COLUMN IN RESPONSE TO THE P
ROMPTS."
155 PRINT"TYPE 999 TO TERMINATE DATA INPUT"
160 PRINT:PRINT"THE PROGRAM WILL ADD 128 TO EACH TOTAL TO GENERATE
PRINTER"
170 PRINT"GRAPHICS IN A LINE USING EACH TO THE FONTS AVAILABLE TO
GRAPHICS"
180 PRINT"IT WILL ALSO PRINT OUT THE COLUMN TOTALS FOR REFERENCE."
190 PRINT:PRINT"HIT ANY KEY TO BEGIN"
200 PRINT:PRINT:PRINT
210 IF INKEY$="" THEN 210
220 CLS
230 CLEAR500
240 DIMN(50)
241 DIMN1(50)
250 Z=1
260 '*****
270 ' INPUT CODES
280 '*****
290 CLS
300 I=1
305 CL=65
310 PRINT"PIN COLUMN ";CNR$(CL);"; ";
315 INPUT N(I)
320 IFN(I)=999 THEN 370
330 IFN(I)>127PRINT"TOO HIGH-MUST BE UNDER 127":GOTO310
331 INPUT"BOTTOM HALF ";N1(I)
332 IFN1(I)>127THEN PRINT"TOO HIGH-MUST BE UNDER 127":GOTO331
350 I=I+1
355 CL=CL+1
360 GOTO310
370 '*****
380 ' SEND TO PRINTER
390 '*****
400 T=I
410 FORI=1TOT
415 IFN(I)=999 THEN N(I)=0
420 A$=CHR$(N(I)+128)
430 LPRINT CHR$(10);A$; ' put into graphics mode and lprint CHR$
440 NEXTI
441 LPRINT""
442 FORI=1TOT
443 B$=CHR$(N1(I)+128)
444 LPRINTCHR$(10);B$;
445 NEXTI
450 LPRINTCHR$(30) 'set to non-graphic text
460 LPRINTCHR$(27);CNR$(20) 'set to condensed for code number prin
tout
465 LPRINT"TOP "
470 FORI=1TO(T-1):LPRINTN(I);:LPRINT" ";
480 NEXTI
481 LPRINT""
483 LPRINT"BOTTOM "
485 FORI=1TO(T-1):LPRINTN1(I);:LPRINT" ";:NEXTI
490 '*****
500 ' SEND LINE OF CUSTOM CHARACTERS TO PRINTER
530 ' SET CHARACTER FONT FOR LINE OF CUST. CHAR
540 '*****
560 CLS
570 IFZ>1THENLPRINTCHR$(27);CHR$(15) 'get out of Expanded mode
580 ONZ GOTO 590 ,610 ,630 ,650
590 LPRINT CHR$(27);CHR$(14) 'expanded mode
600 GOTO670
610 LPRINTCHR$(27);CNR$(19) 'normal characters
620 GOTO670
630 LPRINTCHR$(27);CHR$(20) 'condensed mode
640 GOTO670
650 RUN240
660 '*****
670 ' PRINTOUT OF CHAR REPEATED 20 TIMES
671 '*****
680 FORI=1TO20
690 FORI=1TO(T-1)
700 A$=CHR$(N(I)+128) 'add 128 to pin number to produce CNR$ code
710 LPRINTCHR$(18);A$; 'go into graphics mode and print char
720 NEXTI:NEXTI
721 LPRINT""
722 FORI=1TO20
723 FORI=1TO(T-1)
724 B$=CHR$(N1(I)+128)
725 LPRINTCHR$(10);B$;
726 NEXTI:NEXTI

```

Listing 3 continued

Listing 3 continued

```
727 LPRINT""
730 LPRINTCHR$(30) 'get out of graphics mode
740 Z=Z+1
750 GOTO 570
```

End

Program Listing 4. Subroutine using string method.

```
2000 'STRINGS/GS3
2010 '2 seconds to load buffer and printout line
2020 'add 120 to each pin column total
2030 A$=CHR$(129)+CHR$(131)+CHR$(159)+CHR$(191)+CHR$(254)+CHR$(252)
2040 A1$=CHR$(240)+CHR$(224)+CHR$(220)+CHR$(194)+CHR$(161)+CHR$(15
3)+CHR$(133)+CHR$(131)
2050 LPRINTCHR$(27);CHR$(14)'set printer to expanded mode
2060 LPRINTCHR$(10)'set to graphics mode
2070 FORI=1TO17
2080 LPRINTA$+A1$;
2090 NEXTI
2100 LPRINTCHR$(27);CHR$(15)'reset printer out of expanded mode
2110 LPRINTCHR$(30)'reset printer to non-graphics mode
2120 RETURN
```

End

Program Listing 5. Subroutine that prints graphics line.

```
3000 'SUBGRAF/GS4
3010 'Subroutine to print graphic line (rolling ribbon graphic)
3020 '17 second delay to fill buffer and print
3030 LPRINTCHR$(27);CHR$(20)'set to condensed mode
3040 LPRINTCHR$(10)'set to graphics mode
3050 FORI=1TO50
3060 READN:IFN=999THEN3000
3070 IFN=0 THEN LPRINTCHR$(120+N);GOTO3060
3080 LPRINT;
3090 RESTORE 'set to read data again
3100 NEXTI
3110 LPRINTCHR$(30)'reset printer to non-graphics mode
3120 DATA1,3,7,31,63,126,124,112,96,92,66,33,25,5,1,999
3130 RETURN
```

End

Program Listing 6. Subroutine that prints graphics line.

```
3000 'SUBGRAF/GS5
3005 DIMM(20)
3010 'Subroutine to print graphic line (rolling ribbon graphic)
3020 'ONLY 9 second delay to fill buffer and print
3030 LPRINTCHR$(27);CHR$(20)'set to condensed mode
3040 LPRINTCHR$(10)'set to graphics mode
3050 I=1
3060 READN:M(I)=N:IFN>255THEN3000
3070 I=I+1:GOTO3060
3080 T=I:FORJ=1TO50
3090 FORI=1TO(T-1):LPRINTCHR$(M(I)+120);:NEXT
3100 NEXTJ
3110 LPRINTCHR$(30)'reset printer to non-graphics mode
3120 DATA1,3,7,31,63,126,124,112,96,92,66,33,25,5,1,999
3130 RETURN
```

End

Program Listing 7. Subroutine that prints two-line characters.

```
3000 'SUBGRAF/GS6 double high graphic
3010 DIMM(20),M1(20)
3020 LPRINTCHR$(27);CHR$(14)'set printer to expanded mode
3030 LPRINTCHR$(10)'set printer to graphic mode
3040 'Read and printout top portion graphic
3050 I=1
3060 READN:M(I)=N:IFN>255THEN3000
3070 I=I+1:GOTO3060
3080 T=I:FORJ=1TO20
3090 FORI=1TO(T-1):LPRINTCHR$(M(I)+120);:NEXT
3100 NEXTJ
3110 'Read and printout bottom portion graphic
3120 I=1:LPRINT
3130 READN1:M1(I)=N1:IFN1>255THEN3150
3140 I=I+1:GOTO3130
3150 T=I:FORJ=1TO20
3160 PRINT:FORI=1TO(T-1):LPRINTCHR$(M1(I)+120);:NEXT
3170 NEXTJ
3180 LPRINTCHR$(30)'reset printer to non-graphics mode
3190 LPRINTCHR$(27);CHR$(15)'reset printer out of expanded mode
3200 DATA 0,0,126,1,125,5,5,5,5,5,125,1,126,0,0,0,999
3210 DATA 0,126,65,85,73,85,73,85,73,85,73,85,72,65,126,0,0,999
3220 RETURN
```

End



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ON THE RECORD

Sequential random-access files each have their own advantages and disadvantages for data storage and retrieval. Here's a way to combine the best features of both.

Sequential files use disk space efficiently, but they have their disadvantages. To update records, a program must read and write an entire file. And searching for a specific record can require extensive disk input/output or main memory, depending on the technique you use. Random-access files (also called direct-access files) don't have these drawbacks and, with good planning, they can be reasonably efficient users of disk space.

I'll introduce three Model I/III Basic programs that create and sort indexed random-access files, letting you easily manipulate data stored on disk. First, however, I'll describe how random-access files work.

Records and Subrecords

Table 1 shows the Disk Basic commands you use to create and access random files. Random-access files store data in buffers. A buffer is one 255-character record; you can define subrecords (i.e., fields) within the buffer using the Field command. The Get command accesses the full record; you need a file-handling program to access the subrecords.

For example, assume you want a file of names and phone numbers that sets aside 25 characters for a name and 12 characters for a phone number. Positions 1-25 in the file buffer contain name characters and positions 26-37 contain the phone number. Each 255-character main record could hold

six of these 37-character subrecords, with 33 unused characters left over.

Here's how you'd open this file and define its fields:

```
10 OPEN 1, "R", "NAMEPHON/RND:1"
20 FOR I% = 0 TO 5
30 FIELLO 1,(I%*37) AS DMS, 25 AS NM$(I%),
40 NEXT I%
```

Line 10 opens the file as a random file. If the file already exists, the system finds it. If it doesn't, the system creates it. Line 20 determines that the program creates six subrecords. In line 30, the statement `(I%*37) AS DMS` sets up a pointer to the beginning of each subrecord; the rest of the line describes each field within the record.

Program Listing 1 creates the random-access file described above to hold your data. Program Listing 2 reads the file sequentially. Whether you access the file randomly or sequentially, you always define fields as shown. You access the record using Get to call the full record. Then you use a file-handling program to locate the subrecord you want.

To write a record, you always fill the buffer using LSET (for left-justified data) or RSET (for right-justified data) with a specified subrecord position. These commands pad data that doesn't quite fill the buffer. Then you write the file to disk using Put with the main record number.

Indexing Your Files

As you can see, reading and writing a random file sequentially isn't too complicated. However, to read a file randomly, your program must have a way to determine the main record number (which I call MR%) and the subrecord number (SR%) of the file in which you're interested. In other words, you need an index of the records stored in the random-access file. I use a sequential index file to point to the random records. It's easy to use and control, and has the advantage of letting you search the index by more than one key word.

One important aspect of random-access files to remember is that fields in random files are absolute in size; you use LSET or RSET to fill the fields to the right or left, with spaces added to fill the buffer. (A sequential file's fields generally vary in size with the data and use a delimiter, like a comma, to define the fields.)

Program Listing 3 demonstrates my indexing technique with a program that catalogues my applications programs. Listing 3 stores data in the fields shown in Table 2. It includes entries for the program name, author, application, and the disk on which it's stored. You could use the same procedure to create a file of names and phone numbers, candidates and votes received, and so on. I've listed all variables at the end of the

The Key Box



Models I and III
32K RAM
Disk Basic
NEWDOS80 (for sort)

Command	Description
Field	Defines buffer
LSET/RSET	Positions data in buffer
Put	Writes the buffer
Get	Reads the buffer
LOF	Sets pointer to last main record of file

Table 1. Commands for manipulating random files.

Position	Length (in bytes)	Description
1-12	12	Program name
13-16	4	Application
17-24	8	Disk name
25	1	Side
26-27	2	Grans
28-37	10	Author
38-57	20	Description

Table 2. Fields for program reference file.

The index file controls access to the random file using the program's name as the key.

program; they're for reference and shouldn't be typed in.

When you run the program, it displays a menu of three options: adding a new file, changing or deleting a file, or exiting the program. As you update records, the program creates a sequential index file in memory using arrays. The program writes out this index file at the end of the job; the file controls access to the random file and uses the program name as the key field.

Each index file record has the format XXXXXXXX/XXX, MR%, SR%; that is, the program name, the main record number (file or buffer number) and the subrecord number. The variables MR% and SR% of the index file point straight to the random record for any specific program name. Table 3 describes the main routines of Listing 3.

Program Listing 4 creates, sorts, and writes two index files from the main random file in Program Listing 3, one using the program name as the key word, the other using the application. Don't sort or change the index file; it controls the update procedure. The sort in lines 240 and 270 is a system sort available under NEWDOS80 2.0. Alternatively, you can insert a sort for your own DOS (for a TRSDOS sort, see "Proper Arrangements," June 1984, p. 96).

Program Listing 5 searches the random file in Program Listing 3 using the two index files created in Listing 4. By creating an index file that can have any field as the key, you can sort the file or access records in any sequence you want.

This technique has saved me the trouble of finding a good algorithm for randomizing the key field (which would have to be unique) into a main record and a subrecord. I feel that I have better control, and the pointers are so simple that they're less likely to get out of sync and send all my data into never-never land. This method should help programmers manipulate random files more easily and confidently. ■

You can reach Jane Goodale at 828 N. 121st St., Omaha, NE 68154.

Lines	Description
10-20	Initialize variables.
30	Read index file. If it doesn't exist, On Error routine takes care of it.
40-50	Initialize and field random file buffer.
70-90	Menu.
100-190	Add to file. Last record added will be displayed first. To duplicate a field from previous record press the enter key. If a deleted record exists (* in program name) the record is put there. Otherwise it's added at the end.
200-260	Change or delete. Asks for program name, displays the record, and positions cursor under each field in turn. Change field by entering new data, or leave as is by pressing enter. Delete record by typing asterisk (*) in the program name field. Line 260 returns to line 230 where 1% is stepped up to find the next occurrence of the same program name, which handles the duplicate key.
400-420	Locate the first deleted record.
500-570	Set variables for input routine.
600	Get data from the random file buffer based on subrecord number XS%.
700-720	Fill random file buffer.
750-760	Fill unused subrecords with x's.
800-810	On Error routine.
900-920	End of job. Writes index file. At this point, I run Listing 4 to create two more index files.
1000-1140	William Barden's Universal Gee Whiz Input routine. See <i>Programming Techniques for Level II Basic</i> , p. 57, for full discussion.

Table 3. Main routines for Program Listing 3.

Program Listing 1. Creates a random-access disk file. Add lines 10-40 from p. 106.

```

100 MR%=1 ' initialize main record number
110 FOR SR%=0 TO 5 ' six subrecords to fill
120 INPUT"ENTER NAME ( '*' TO EXIT );N$
130 IF N$="*" THEN GOTO 210
140 INPUT"ENTER PHONE";P$
150 LSET N$(SR%)=N$ ' fill buffer
160 LSET P$(SR%)=P$
170 NEXT SR% ' step up subrecord number
180 PUT 1,MR% ' when six are filled, then Put
190 MR%=MR%+1 ' now step up main record number
200 GOTO 110 'and loop back
210 IF SR%=0 THEN 230 'last record
220 PUT 1,MR% ' otherwise write it out
230 CLOSE 1:END

```

End

Program Listing 2. Reads a random file sequentially. Add lines 10-40 from p. 106.

```

100 FOR MR%=1 TO LOP
120 GET 1,MR%
130 FOR SR%=0 TO 5
140 PRINT N$(SR%),P$(SR%) 'subscripted fields
150 NEXT SR%
160 NEXT MR%
170 CLOSE 1: END

```

End

Program Listing 3. Creates indexed random files.

```

1 REM RANDISKU/BAS JN GOODALE
2 REM CREATE AND/OR UPOATE A RANDOM FILE OF PROGRAM
3 REM AND DATA INFORMATION ON DISKS
0 REM
9 REM INITIALIZE -----
10 CLEAR25000:CLS:PRINTTAB(15)"UPDATE PROGRAM INFORMATION FILE":PR
INT0340,"INITIALIZING":DEFINTA-Z:DIMIP$(500),IM$(500),IS$(500):ES=
"##":B2$="PROGRAM APPL DISK S GR AUTHOR DESCRIPTION":
B3$=STRING$(63,"")
20 MR%=1:SR%=0:N%=0:FI$="DISKINX/INX:1":FR$="OISKINX/RND:1":ONER
RORGOTO000:OPEN"I",1,FI$
29 REM READ INDEX -----

```

Listing 3 continued

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Listing 3 continued

```

38 INPUT#1,IP$(N%),IN$(H%),IS$(N%):IFEOF(1)THEN40ELSEN%-N%+1:GOTO3
8
39 REM INITIALIZE RANDOM FILE BUFFERS -----
40 CLOSE1:NR%=IN$(N%):SR%=IS$(N%):GOSUB420
50 OPEN"R",1,PR$:FIELD1,255 AS DX$:LSET DX$=STRING$(255,"X"):FORI%
=0TO3:FIELD1,(I%*57)AS DM$,12 AS PG$(I%),4 AS AP$(I%),0 AS DS$(I%)
,1 AS SD$(I%),2 AS GR$(I%),10 AS AU$(I%),20 AS DS$(I%):NEXTI%:IPH$
="Y"THEN100
69 REM MAIN MENU -----
70 CLS:PRINTTAB(15)"UPDATE PROGRAM INFORMATION FILE":PRINTTAB(15)
B(20)"1) ADD TO FILE":PRINTTAB(20)"2) CHANGE/DELETE":PRINTTAB(20)
) "3) END PROGRAM":PRINT:PRINTTAB(18) ".... CHOICE (DO NOT HIT
<ENTER>)"
80 KS=INKEY$:IFKS=""THEN00ELSEPRINT$:ONVAL(KS)GOTO100,200,900
90 GOTO70
99 REM ADD TO FILE -----
100 IFPH$="Y"THEN120ELSEIFPH$="Y"THEN120
110 GET1,NR%:XS%=SR%:GOSUB600:N%-N%+1:IFSR%=3THENSR%=0:NR%=NR%+1EL
SESR%=SR%+1
120 CLS:PRINTTAB(93)"ADD TO FILE : ('' TO ESCAPE, <ENTER> TO R
EPEAT)":PRINTN2$:PRINTN3$
130 IFDS$="Y"THENGOSUB400:GOTO100ELSEIFPH$="Y"THEN145
140 PRINTPG$:TAB(13)AP$:TAB(18)DM$:TAB(27)SD$:TAB(29)USING$;GR%:
PRINTTAB(32)AU$:TAB(43)DS$
145 FORI%=2TO13:ZX=I%*64+12B:GOSUB500:IFZAS$=""THEN180
150 XS%=SR%:XN%=NR%:XI=N%:GOSUB700:IFSR%=3THENPUT1,NR%:NR%=NR%+1:S
R%=0ELSESR%=SR%+1
160 N$="N":N%=N%+1:IFN%>500THENN%=500:GOTO900
170 NEXTI%:GOTO120
180 N%-N%-1:IFSR%>0THENGOSUB750:SR%=SR%-1ELSENR%=NR%-1:SR%=3
190 GOTO70
199 REM CHANGE/DELETE -----
200 CLS:PRINTTAB(24)"CHANGE/DELETE":PRINTTAB(12)"'' TO DELETE":TA
B(31)"<ENTER> TO LEAVE AS IS":PRINTTAB(18)"PROGRAM NAME :":PF$="N
OT FOUND"
210 ZZ=12:ZC=161:GOSUB1000:IFZAS$=""THEN70ELSEPG$=ZAS$:PRINT " :PG$
=PG$+STRING$(12-LEN(PG$)," ")
220 FORI%=0TON%:IFPG$=IP$(I%)THEN240
230 NEXTI%:PRINT " :PRINTTAB(18)"PROGRAM " :PG$:PF$:INPUT".....<ENT
ER> TO CONTINUE":F$:GOTO70
240 XN%=IN$(I%):XS%=XS$(I%):GET1,XN%:XI=I%:GOSUB600:PRINT@192,H2$:
PRINTN3$:PRINTPG$:TAB(13)AP$:TAB(18)DM$:TAB(27)SD$:TAB(29)USING$;
GR%:PRINTTAB(32)AU$:TAB(43)DS$
250 ZX=304:GOSUB500:IFZAS$=""THENPG$="":DS$="Y":DM%=XN%:DS%=XS%:DR
%=XI
260 GOSUB700:PUT1,XN%:F$=" FINISHED":GOTO230
399 REM LOCATE DELETED RECORD -----
400 DS$="N":ZX=192:GOSUB500:IFZAS$=""THENDS$="Y":GOTO440
410 XS%=DS%:XN%=DM%:XI=DR%:GET1,DM%:GOSUB700:PUT1,DM%
420 FORI%=0TON%:IFIP$(I%)=""THENDS$="Y":DM%=IN$(I%):DS%=IS$(I%):DR
%=I%:GOTO440
430 NEXTI%
440 RETURN
499 REM SCREEN LAYOUT AND INPUT -----
500 ZZ=12:ZC=ZX:GOSUB1000:IFZAS$=""THEN570ELSEIFZAS$<>""THENPG$=ZAS$
510 ZZ=4:ZC=ZX+13:GOSUB1000:IFZAS$=""THEN570ELSEIFZAS$<>""THENAP$=Z
AS$
520 ZZ=B:ZC=ZX+10:GOSUB1000:IFZAS$=""THENDS$="Y":THENDN$=Z
AS$
530 ZZ=1:ZC=ZX+27:GOSUB1000:IFZAS$=""THEN570ELSEIFZAS$<>""THENDSD$=Z
AS$
540 ZZ=2:ZC=ZX+29:GOSUB1000:IFZAS$=""THEN570ELSEIFZAS$<>""THENGRA$=V
AL(ZAS$)
550 ZZ=10:ZC=ZX+32:GOSUB1000:IFZAS$=""THEN570ELSEIFZAS$<>""THENAU$=
ZAS$
560 ZZ=20:ZC=ZX+43:GOSUB1000:IFZAS$=""THEN570ELSEIFZAS$<>""THENDSS$=
ZAS$
570 RETURN
599 REM DEFINE DATA -----
600 PG$=PG$(XS%):AP$=AP$(XS%):DN$=DN$(XS%):SD$=SD$(XS%):GR%=CVI(GR
$(XS%)):AU$=AU$(XS%):DS$=DS$(XS%):RETURN
699 REM FILL BUFFER -----
700 LSETPG$(XS%)=PG$:LSETAP$(XS%)=AP$:LSETDN$(XS%)=DN$:LSETSD$(XS%)
=SD$:LSETGR$(XS%)=GR%:LSETAU$(XS%)=AU$:LSETDS$(XS%)=DS$
710 IP$(XI)=PG$(XS%):IN$(XI)=XN%:IS$(XI)=XS%
720 RETURN
749 REM FILL UNUSED SUB RECORDS -----
750 XI=H%+1:XN%=NR%:PG$="X":AP$="X":DN$="X":SD$="X":GR$="0":AU$="X
":DS$="X"
760 FORXS%=SR%TO3:GOSUB700:NEXTXS%:PUT1,NR%:RETURN
799 REM ON ERROR ROUTINE -----
800 IPERL=20THENN$="Y":RESUME50
810 PRINT"ERROR :ERR/2+1," IN LINE " :ERL:END
899 REM END -----
900 CLOSE1:OPEN"D",1,PI$:PRINT"CREATING RANDOM INDEX FILE"
910 FORI%=0TON%:PRINT#1,IP$(I%),",",IN$(I%),",",IS$(I%):NEXTI%:CLO
SE1

```

Listing 3 continued

```

920 CLS:PRINT"END OF UPDATE .... NOW RUNNING PROGRAM INDEX":RUN"RA
NDISK1/BAS"
999 REM BARDEN'S INPUT ROUTINE -----
1000 ZA$=STRING$(ZZ,"."):PRINT@ZC,ZA$,CHR$(14);:ZA=LEN(ZA$):PORZF=
1TOZA:PRINTCHR$(24);:NEXTZF:ZA$=STRING$(ZA,32):ZG=1
1010 ZR$=INKEY$:IFZN$=""THEN1010
1020 IFZN$=CHR$(0)ORZN$=CHR$(9)ORZN$=CHR$(13)GOTO1040
1030 IFZN$<CHR$(32)GOTO1010
1040 IFZN$<>CHR$(0)GOTO1070
1050 IFZG=1GOTO1010ELSEPRINTCHR$(24);
1060 ZG=ZG+1:GOTO1010
1070 IFZN$<>CHR$(9)GOTO1090
1080 IFZG>=ZAGOTO1010ELSEPRINTCHR$(25);:ZG=ZG+1:GOTO1010
1090 IFZN$<>CHR$(13)GOTO1100ELSEPRINT@ZC,CHR$(15);STRING$(ZA+1,32)
;:PRINT@ZC,ZA$;:ZA$=LEFT$(ZA$,ZG-1):RETURN
1100 ZG=ZG+1
1110 IFZG>ZA+1PRINTCHR$(24);
1120 IFZG>ZA+1ZG=ZG-1
1130 PRINTZB$;:IFZN$="",THENZN$=CHR$(129)ELSEIFZN$="":THENZN$=CHR$(
130)
1140 ZA$=LEFT$(ZA$, (ZG-2))+ZN$+RIGHT$(ZA$, ZA-ZG+1):GOTO1010
1200 REM
1210 REM
1220 REM VARIABLE VARIABLE LIST
1230 REM DESCRIPTION
1240 REM AP$() APPLICATION IN SUB RECORD
1250 REM AU$() AUTHOR IN SUB RECORD
1260 REM DS$ DELETE SWITCH
1270 REM DM$ DUMMY RECORD FOR BUFFER
1280 REM DN$ MAIN RECORD NUMBER OF DELETED RECORD
1290 REM DN$() DISK NAME IN SUB RECORD
1300 REM DS$() DESCRIPTION IN SUB RECORD
1310 REM DS$ SUB RECORD NUMBER OF DELETED RECORD
1320 REM DX$ DUMMY STRING FOR START-UP
1330 REM ES$ EDIT STRING
1340 REM FS$ COMMENT STRING ('NOT FOUND' OR 'FINISHED')
1350 REM FIS$ FILE SPEC OF INDEX FILE
1360 REM FR$ FILE SPEC OF RANDOM FILE
1370 REM GR$() GRANS (OBTAINED FROM NRI$(GR$) IN SUB RECO
RD
1380 REM GR$ GRANS
1390 REM HZ$ HEADING
1400 REM N3$ HEADING
1410 REM I% TEMP - USED IN FOR NEXT LOOPS
1420 REM IN%() MAIN RECORD NUMBER IN INDEX FILE
1430 REM IP$() PROGRAM NAME IN INDEX FILE
1440 REM IS%() SUB RECORD NUMBER IN INDEX FILE
1450 REM K$ TEMP - INREYS
1460 REM NR$ MAIN RECORD NUMBER
1470 REM N$ NEW FILE SWITCH ("Y" IF NEW FILE)
1480 REM N% NUMBER OF RECORDS ON INDEX FILE
1490 REM PGS$() PROGRAM NAME IN SUB RECORD
1500 REM SD$() SIDE IN SUB RECORD
1510 REM SR$ SUB RECORD NUMBER
1520 REM X% TEMP - I% IN SUBROUTINE 700
1530 REM XN% TEMP - NR% IN SUBROUTINE 700
1540 REM XS% TEMP - SR% IN SUBROUTINE 700
1550 REM ZA TEMP - USED IN INPUT ROUTINE 1000
1560 REM ZA$ TEMP - RESULTS OF INPUT ROUTINE
1570 REM ZC TEMP - CURSOR POSITION FOR INPUT ROUTINE
1580 REM ZF TEMP - USED IN INPUT ROUTINE
1590 REM ZG TEMP - USED IN INPUT ROUTINE
1600 REM ZN$ TEMP - USED IN INPUT ROUTINE
1610 REM ZX TEMP - POINTS TO BEGINNING OF LINE FOR INP
UT
1620 REM ZZ TEMP - LENGTH OF FIELD FOR INPUT ROUTINE

```

End

Program Listing 4. Adds and sorts two indexes.

```

1 REM RANDISK1/BAS JN GOODALE 03/27/82
3 REM CREATE KEY INDEX FILES FOR FIELDS
4 REM OF A RANDOM FILE.
9 REM INITIALIZE .....
10 CLEAR23000:DEFINTA-Z:DIMIP$(500),IA$(500),IN$(500),IS$(500),S%(
500)
20 FR$="DISKINDX/RND:1":CLS:PRINT"READING PROGRAM INFORMATION FILE
"
50 OPEN"R",1,FR$:FIELD1,255 AS DX$:LSET DX$=STRING$(255,"X"):FORI%
=0TO3:FIELD1,(I%*57)AS DM$,12 AS PGS$(I%),4 AS AP$(I%),0 AS DN$(I%)
,1 AS SD$(I%),2 AS GR$(I%),10 AS AU$(I%),20 AS DS$(I%):NEXTI%
100 N%=0:FORMR%=1TOLOP(1):GET1,NR%
110 FORSR%=0TO3

```

Listing 4 continued

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Listing 4 continued

```

120 IN%(N%)=MR%:IS%(N%)=SR%:IP$(N%)=PG$(SR%):IA$(N%)=AP$(SR%)
130 N%=N%+1
140 NEXTSR%
150 NEXTMR%:N%=N%-1
199 REM MAIN ROUTINE .....
200 CLOSE1:FI$="DISKINDX/INA:1":GOSUB240:W=1:W$="APPLICATION":GOSU
B300
210 FI$="DISKINDX/INP:1":GOSUB270:W=2:W$="PROGRAM":GOSUB300
230 GOTO900
240 CHD"O",N%+1,*S%(0),IA$(0):RETURN
270 CHD"O",N%+1,*S%(0),IP$(0):RETURN
299 REM DO IT .....
300 PRINT:PRINT"WRITING : ";W$:OPEN"O",1,FI$
310 FORI%=0TON%:S%=S%(I%)
320 ONWGOTO330,340
330 F$=IA$(S%):GOTO360
340 F$=IP$(S%):GOTO360
360 PRINT#1,F$," ";I%(S%);",";IS%(S%)
370 NEXTI%:CLOSE1:RETURN
899 REM END OF JOB .....
900 PRINT " ":PRINT"END OF JOB"
920 END

```

End

Program Listing 5. Searches random file using indexes created by Listing 4.

```

I REM LOOKDISK/BAS JN GOODALE
3 REM SEARCH AND DISPLAY RANDOM FILE OF PROGRAM
4 REM INFORMATION USING A SEQUENTIAL FILE TO
5 REM REFERENCE THE RECORDS
9 REM INITIALIZE .....
10 CLEAR20000:CLS:PRINTTAB(15)"SEARCH/DISPLAY PROGRAM INFORMATON F
ILE":PRINT#340,"INITIALIZING":DEFINTA-Z:DIMIP$(500),IM$(500),IS%(5
00):E$="##":H2$="PROGRAM APPL DISK S GR AUTHOR DESCR
PTION":H3$=STRING$(63,"=")
20 FR$="DISKINDX/RND:1"
30 CLS:PRINTTAB(20)"SEARCH/DISPLAY PROGRAM":PRINT:PRINTTAB(15)"USI
NG ONE OF THE FOLLOWING KEYS :":PRINTTAB(20)"1) PROGRAM":PRINTTAB
(20)"2) APPLICATION"
40 PRINT:PRINT"ENTER CHOICE (DO NOT HIT <ENTER>) --> ";
50 K$=INKEY$:IFK$=""THEN50ELSEPRINTK$:ONVAL(K$)GOTO80,90
60 GOTO30
80 L=12:C$="PROGRAM NAME":C=1:FI$="DISKINDX/INP:1":GOTO120
90 L=4:C$="APPLICATION":C=2:FI$="DISKINDX/INA:1":GOTO120
120 N%=0:OPEN"1",1,FI$
130 INPUT#1,IP$(N%),IM$(N%),IS%(N%):IFEOF(1)THEN140ELSEN%=N%+1:GOT
O130
140 CLOSE1:OPEN"R",1,FR$:FIELD1,255 AS DX$:LSET DX$=STRING$(255,"X
"):FORI%=0TO3:FIELD1,(I%*57)AS DM$,12 AS PG$(I%),4 AS AP$(I%),8 AS
DN$(I%),1 AS SD$(I%),2 AS GR$(I%),10 AS AU$(I%),20 AS DS$(I%):NEX
TI%
150 CLS:PRINTTAB(15)"DISPLAY PROGRAM INFORMATION FILE":PRINT:PRINT
TAB(20)"1) SEARCH":PRINTTAB(20)"2) DISPLAY ALL":PRINTTAB(20)"3)
RESTART":PRINTTAB(20)"4) END":PRINT:PRINT".... CHOICE (DO NOT
HIT <ENTER>) ...> ";
160 K$=INKEY$:IFK$=""THEN160ELSEPRINTK$:ONVAL(K$)GOTO180,240,460,4
70
170 GOTO150
180 CLS:PRINTTAB(20)"SEARCH ON : ";C$:PRINT
190 PRINT"ENTER ";C$:INPUTS$:LC%=1:H1$=S$:LM%=0:GOSUB410
200 S$=S$+STRING$(L-LEN(S$)," "):FORI%=0TON%:IFS$=IP$(I%)THENGOSUB
300
210 NEXTI%:GOSUB360:GOTO150
240 LC%=1:CLS:PRINTTAB(10)"DISPLAY FILE IN SEQUENCE BY :";C$:HI$=C
$
290 GOSUB410:LM%=0:FORI%=0TON%:MR%=IM%(I%):SR%=IS%(I%):GOSUB310:NE
XTI%:PRINT"END OF FILE":GOSUB380:GOTO150
300 MR%=IM%(I%):SR%=IS%(I%)
310 IFMR%<>LM%THENGET1,MR%
320 LM%=MR%:KS%=SR%:GOSUB440
330 PRINTPG$;TAB(13)AP$;TAB(10)DN$;TAB(27)SD$;TAB(29)USING$;GR%;:
PRINTTAB(32)AU$;TAB(43)DS$
340 IFINT(LC%/10)=LC%/10THENGOSUB380:GOSUB410
350 LC%=LC%+1:RETURN
360 PRINT"END SEARCH ON ";S$:GOSUB380:RETURN
370 REM CONTINUE OR QUIT PROMPT .....
380 PRINT#960,"..Q' TO QUIT ..... <ENTER> TO CONTINUE ";
390 K$=INKEY$:IFK$=""THEN390ELSEIFK$="Q"THENGOTO150
400 RETURN
410 CLS:PRINTTAB(10)"PROGRAM INFORMATION FILE BY ";H1$
420 PRINT:PRINTB2$:PRINTB3$:RETURN
430 REM DEFINE DATA -----
440 PG$=PG$(XS%):AP$=AP$(XS%):DN$=DN$(XS%):SD$=SD$(XS%):GR%=CVI(GR
$(XS%)):AU$=AU$(XS%):DS$=DS$(XS%):RETURN
450 REM END OF JOB .....
460 RUN
470 CLOSE1:PRINT " ":PRINT"END OF JOB";

```

End

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PATCH WORK

You get a paging directory, pause control for program listings, full error messages, file identification with the Auto command, and more with these 13 patches to TRSDOS 1.3.

Tired of TRSDOS 1.3? If your answer is yes, take comfort in the fact that you're not alone. While Model III TRSDOS is a vast improvement over TRSDOS 2.3, it isn't perfect. I've developed a series of patches, however, that promise to smooth some of TRSDOS 1.3's rough edges.

The 13 patches included here make TRSDOS 1.3 a more efficient operating system. They give you an abridged TRSDOS directory, correct a TRSDOS bug for nonexistent files, display a directory one page at a time, pause a program or directory listing with the same command, eliminate the need for a colon with the Directory command, identify a file you load with the Auto command, list free disk space in detail, provide full error messages, refine the TRSDOS Ready prompt, change the TRSDOS boot-up banner, administer a better formatting test for new disks, and eliminate TRSDOS's "Operation Aborted" message. You don't have to install all the patches; rather, you can pick and choose as you please.

The Patches

You install the patches with the TRSDOS Patch command. It's simple to use. Start at TRSDOS Ready, type in the patches you want, check for typographical errors, and press the enter key to finish the command. If you get an error message, try to figure out what went wrong before continuing. You must copy all the command lines listed in the patch you select. For example, if the patch consists of four patch lines, you must enter all four lines, as four separate TRSDOS commands. Don't enter any other DOS commands until you've completed all patching.

Patch 1, the Catalogue command, gives you an abridged directory from the TRSDOS Ready prompt, eliminating the problems associated with TRSDOS

1.3's Directory command. Patch 1 eliminates TRSDOS's Route command and "Operation Aborted" message, so it doesn't use additional disk, directory, or memory space. The directory listing, however, isn't as complete as the original TRSDOS listing.

To install this patch correctly, first make sure that your TRSDOS 1.3 short directory routine in Basic works and then type in the patch. To call the new command, type CAT or CAT (drive number) from TRSDOS Ready, and press the enter key.

Note that section (a) of Patch 1 contains the two patches issued by Radio Shack (see *TRS-80 Microcomputing News*, October 1981, p. 13). Ignore section (a) if you've already incorporated this change. Type in the patch as listed:

(a) Radio Shack fix:

PATCH *10 (ADD = 4E2E, FIND = CD3E4B, CHG = CD8A50)

PATCH *10 (ADD = 508A, FIND = 4469736B, CHG = 4FC33E4B)

(b) The Catalogue command:

PATCH *1 (ADD = 50A9, FIND = 4F7065726174, CHG = 0D7EFE343004)

PATCH *1 (ADD = 50AF, FIND = 696F6E204162, CHG = FE3030023E30)

PATCH *1 (ADD = 50B5, FIND = 6F727465640D, CHG = 327142C31944)

PATCH *1 (ADD = 51C9, FIND = 524F55544520A842, CHG = 434154202020AA50)

Patch 2 fixes a bug in TRSDOS 1.3 that results when TRSDOS tries to list nonexistent files in the disk directory hash index table. The code for Patch 2 is:

PATCH *10 (ADD = 4E47, FIND = 02, CHG = 03)

Patch 3 modifies the Directory com-

mand so that it displays directory files one page at a time. Once you install this patch, type in DIR, press the enter key and the usual long-format directory appears. However, if there are too many entries for one screen, the listing stops and waits for you to press the enter key before displaying the next set of entries. Type in Patch 3 as listed here:

PATCH *6 (ADD = 616D, FIND = CD8861B7C8FE40, CHG = 3A803FD620C8CD)

PATCH *6 (ADD = 6174, FIND = 2806C547AF78C1, CHG = 7C61CDC901AFC9)

Patch 4 applies to TRSDOS 1.3's List command. When you list a file from TRSDOS Ready, the display scrolls unless you pause the listing by pressing the @ key. This patch changes the pause control to the shift-@ key combination. The command is the same as that in Basic, and therefore much easier to remember. The code for Patch 4 is:

PATCH *11 (ADD = 5265, FIND = 40, CHG = 60)

Patch 5 is similar to Patch 4 except that it applies to TRSDOS 1.3's Directory command. It lets you pause a long-format directory listing by pressing the shift and @ keys at the same time, rather than pressing the @ key alone. The reason for this patch is compatibility: It makes the pause control for both the Basic List and the Directory commands the same. Patch 5 shouldn't be applied if you've installed Patch 3. Here's the code for Patch 5:

PATCH *6 (ADD = 6173, FIND = 40, CHG = 60)

Patch 6 gives you the option of including (or not including) a colon when naming the disk drive for the Directory command. The code is:

PATCH *6 (ADD = 59EC, FIND = 7EFE3A2015, CHG = 2BCD781D38)

PATCH *6 (ADD = 59F1, FIND = 237ED630DA, CHG = 06FE3A2010)

PATCH *6 (ADD = 59F6, FIND = 3452FE04D2, CHG = 237ED630DA)

The Key Box



Model III
TRSDOS 1.3

Patch 7 works with the Auto command. When you use the Auto function, your computer displays the name of the file you're automatically loading, rather than just the message "Auto Function Engaged." Type in this patch as:

PATCH *0 (ADD = 4F60, FIND = 6B4F, CHG = 2542)

Patch 8 not only tells you where you have free disk space, but also the amount of space, in grans, available. To make room for this patch, I had to modify the password message of the Prot (PW) command. After you add Patch 8, you're asked "New Master?" instead of "New Master Password?" The code for Patch 8 is:

PATCH *6 (ADD = 5D52, FIND = FE28D0, CHG = CD4555)

PATCH *6 (ADD = 5542, FIND = 2050617373, CHG = 3F2003FE28)

PATCH *6 (ADD = 5547, FIND = 776F72643F, CHG = D8F1C3FC5B)

Patch 9 is a one-byte patch that makes an entire error message appear rather than the error number. Once this patch is in place, you'll see the message without having to enter another command. The code for this patch is:

PATCH *4 (ADD = 4E28, FIND = 20, CHG = 18)

Patch 10 eliminates the row of dots that TRSDOS 1.3 displays after the TRSDOS ready prompt. The code for this patch is:

PATCH *1 (ADD = 4E75, FIND = 063E3E, CHG = C37E4E)

Patch 11 shortens the TRSDOS 1.3 opening banner from a picture of the computer to a single line. It also skips the time and date prompts when you boot-up. A minor problem with this patch is that new files created usually have garbage for the date, although the file itself isn't affected. If this bothers you, install only the first three of the four patch lines for Patch 11. The code is as follows:

PATCH *0 (ADD = 5039, FIND = 20, CHG = 0D)

PATCH *0 (ADD = 508A, FIND = 28, CHG = 0D)

PATCH *0 (ADD = 516C, FIND = D0, CHG = 0D)

PATCH *0 (ADD = 4EA9, FIND = CA, CHG = C3)

Patch 12 provides a better formatting test for new disks. Once you install Patch 12, you can expect more disks to fail the formatting test, but it's better to lose a marginal disk than to lose your important data. Here's the code for Patch 12:

PATCH *7 (ADD = 5BEE, FIND = E5, CHG = 5B)

Patch 13 eliminates the "Operation Aborted" message. Don't apply this patch if you've already installed Patch

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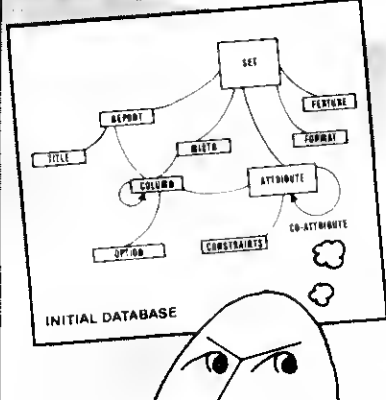
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*Patching is
an easy way
to change a file;
all you
have to do is copy
and enter
a few lines of text.*

1. The code for Patch 13 is:

PATCH *I (ADD = 50A9, FIND = 4F, CHG = 0D)

One final note—the patches won't take effect until you reboot your disk.

Before Patching

When installing a new patch, always use a back-up disk as the Patch command permanently modifies the machine-language system programs stored on disk. Only patch more important disks when you're sure that the patches work as expected; a typographical error could ruin your disk in seconds. If you've applied non-Radio Shack patches to TRSDOS 1.3, the patches given here might not work.

One way to avoid errors is to create a do-file. With the Do and Build commands, you only have to type in the patches once. The do-file is then used to correctly patch as many disks as desired. The procedure for using these commands is explained in the TRSDOS 1.3 manual (also see Douglas Payne's "Brick by Brick," 80 Micro, April 1984, p. 58).

Another option is to use a word processing program to create and edit do-files. A do-file is an ASCII file and most word processing programs work with ASCII files. All you have to do is write command lines, each with 63 characters (or fewer), and a carriage return at the end. Then save the file in ASCII format. You should select a file name ending with the /BLD extension. With a word processor, you can create a master file containing all of the patches listed here. From this master file you can delete and combine the various lines to create new, customized do-files that contain the specific patches that you want to install.

Understanding the Patch Command

The Patch command changes information at a specific location in a disk file. It's an easy way to change a file

since all you have to do is copy and enter a few lines of text. The programmer, on the other hand, must first determine what changes you want made, and then must find available space in the program file to apply those changes. If the file is full, then you must overwrite existing Z80 computer instructions with the new patches. The command format for a patch is as follows: PATCH file-name (ADD = XXXX, FIND = YY, CHG = ZZ).

The first item of information is the file name, necessary so that TRSDOS can find the file and apply the patch. Because TRSDOS 1.3 system files don't have file names, use the format, *#:\$, to identify the decimal number (#) and disk drive (\$) of that system file.

The second item of information in the Patch command indicates where you should make the changes. This information is provided by ADD = XXXX, the next variable on the command line. The "XXXX" is a hexadecimal number representing a memory address. The third item, "FIND = YY", reveals the contents of the disk file at that patch location. Again, the "YY" represents a hexadecimal number; it's possible to have more than one hexadecimal number in a Patch command.

You should know what's on the disk before installing a patch because TRSDOS 1.3 won't complete the patch if the numbers indicated in Find don't match those on the disk file. The advantage of patching with TRSDOS 1.3 is that while it may take longer, it's almost impossible to install a patch in the wrong location.

The final item of the patch format command, "CHG = ZZ", indicates the new information you want on disk. In doing this, TRSDOS 1.3 checks to make sure that the number of Find bytes you need are equal to the number of Find bytes available. If there's no match, the command is aborted with an error message. Otherwise TRSDOS writes the "CHG" bytes to the disk file where the Find bytes had been. The actual switch is made in memory and then written to disk as a modified file sector. For this reason, you can't write-protect your disk when you're patching a file. If you're skilled in hexadecimal math and machine language, you can make minor modifications to a machine-language program without having to re-create the file with an editor/assembler. ■

Write to Andy Levinson at 11575 Sunshine Terrace, Studio City, CA 91604.

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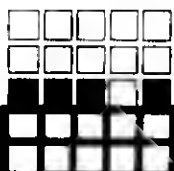
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Formula Solutions

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Complex mathematical formulas have always intrigued me. However, solving these equations by trial and error, or by the quadratic formula, can become tedious and time-consuming. Why not let your computer do the work? I wrote Cubic to solve real or complex roots of cubic, quadratic, and linear algebraic equations.

Using Cubic

Type in and save Cubic (see Program Listing 1, 2, or 3, depending on your sys-

tem). When you run the program, it displays the prompt seen in the Figure. Cubic always displays the formula for a cubic equation (where the greatest exponent is three) and prompts you to enter values for the variables A, B, C, and D.

To solve for a quadratic equation (where no exponent exceeds 2), you need to zero out the first term in the equation by entering a zero for the value of A.

For a linear algebraic equation (no exponent), enter a zero for both the coefficients A and B.

As an example, consider the cubic equation $X^3 + 3X^2 - 4X - 12 = 0$. Coefficient A equals 1 because there's only one X to the power of three, B equals three because there are three X's squared, C equals negative four because four X's are subtracted, and D equals the constant -12. To solve this equation, you enter the values 1, 3, -4, -12, at the coefficient prompt.

Once you enter the coefficients, Cubic displays the real roots of the equation. There are three solutions to this sample problem: 2, -2, and -3.

Cubic then lets you check the veracity of these numbers by prompting you to substitute a number for X in the equation ("CHECK#?"). You can thus reenter and verify Cubic's solutions. This is handy for rechecking suspicious answers.

Consider this quadratic equation: $-2X^2 + 11X - 15 = 0$. The coefficients here are A=0, B=-2, C=11, and D=-15. The first coefficient is zero because there's no X^3 term in the quadratic equation; any term not present is considered to have a coefficient of 0. The two solutions to this quadratic are $X_1 = 2.5$ and $X = 3$.

Complex Roots

Cubic also works with complex roots. Consider this equation: $X^2 - 6X + 25 = 0$. The coefficients are 0, 1, -6, 25, while the solutions are the two complex conjugates $3 + 4i$ and $3 - 4i$, displayed

```
THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS
OF THE STANDARD FORM: F(X) = A*X^3 + B*X^2 + C*X + D
PLEASE INPUT THE COEFFICIENTS A,B,C,D ? 1,3,-4,-12
```

```
THE FIRST REAL ROOT IS X0 = 2
THE OTHER 2 ROOTS ARE
X1 = -2
X2 = -3
Press <ENTER> to END program. CHECK #? -2
F (-2 ) = 0
Press <ENTER> to END program. CHECK #?
READY
```

Figure. Cubic prompts you to enter equation coefficients, then solves for the equation's roots.

Program Listing 1. Cubic for the Model I.

```
0 ' CUBIC/I VERS 2/15/84 by Mike O'Neal
30 PRINT"THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS"
40 PRINT"OF THE STANDARD FORM: F(X) = A*X^3 + B*X^2 + C*X + D"
50 INPUT"PLEASE INPUT THE COEFFICIENTS A,B,C,D ";A3,A2,A1,A0
60 PRINT:IFA3<>0:THEN100
70 IFA2<>0:THENA=A2:B=A1:C=A0:PRINT"TNE";:GOTO190
80 IFA1=0:THEN50
90 PRINT"THE ONLY ROOT IS X = ";-A0/A1:END
100 'CUBIC
110 S=1:L=0:P=1
120 S=L-S:L=L-L:GOSUB300:IFYS<>YLT:THEN140
130 S=-S:L=-L:GOSUB300:IFYS=YLT:THEN120
140 N=(S+L)/2:GOSUB290:IFYS<>YHT:THENL=HESES=H
150 IFABS(L-S)<PTBENP=ABS(L-S):GOTO140
160 PRINT"THE FIRST REAL ROOT IS X0 = ";N:PRINT"THE OTHER";
```

Listing 1 continued

The Key Box



Models I, III, 4, 1000, and 2000
16K RAM Cassette Basic
32K RAM Disk Basic

Using the quadratic formula, Cubic solves the remaining equation.

as $3 \pm 4i$ (i stands for imaginary, meaning the square root of negative one).

To solve $X^2 = -9$, substitute 0, 1, 0, 9 into the program for the result $X = 3i$ or $X = -3i$.

Program Structure

Programmers will notice that Cubic uses the notation X^*X^*X to cube a number instead of X^3 , which calls the computer's built-in exponent capability. My reasoning here is that it's more efficient for Basic to multiply the numbers when the exponent is small. With the built-in exponent function, Basic first must logarithmically convert both the X and the power, then multiply the two numbers together, taking the inverse log to obtain the result.

Cubic first must determine if it's solving a cubic, quadratic, or simple linear equation. Line 100 of all three listings initiates the search for the point where the function crosses the X -axis. Once the first zero is located, Cubic puts the equation into its quadratic form. Using the quadratic formula, Cubic then solves the remaining equation. If the equation is already quadratic, Cubic jumps to line 190; if it's a linear equation, Cubic uses simple algebra to solve for the answer at line 90.

Cubic Versions

I've included three versions of Cubic: The first version (Program Listing 1) is for the Model I Level II tape or disk system, the second version (Program Listing 2) is for Model III Disk Basic, the third version (Program Listing 3) applies to the Models 4, 1000, and 2000. Model 1000 and 2000 users must change the $CHR\$(127)$ in line 260 of Program Listing 3 to $CHR\$(241)$.

If you have a Model III tape system simply use Program Listing 1 and substitute line 260 of Program Listing 2 for line 260 of Program Listing 1. This lets you take advantage of the special algebraic symbol, the plus/minus. In addition, Cubic runs on minimum memory system as the Program Listings are only about 1K in length. ■

Write to Mike O'Neal at 220 N. College Avenue, #18, College Place, WA 99324.

Listing 1 continued

```

170 'SYNTHETIC DIVISION
180 A=A3:B=H*A+A2:C=H*B+A1
190 'QUADRATIC
200 PRINT " 2 ROOTS ARE ";
210 D=B*B-4*A*C:IF D<0 THEN 240
220 X1=(-B+SQR(D))/(2*A):X2=(-B-SQR(D))/(2*A)
230 PRINT:PRINT X1 = ";X1:PRINT X2 = ";X2:GOTO 270
240 PRINT "THE COMPLEX CONJUGATES: ";D=-D
250 XR=-B/(2*A):XI=SQR(D)/ABS(2*A)
260 PRINT XR+"XI":PRINT XR-"XI"
270 S=999999:INPUT "PRESS <ENTER> TO END PROGRAM. CHECK #";S
280 IF S=999999 THEN ELSE GOSUB 8310:PRINT "F ("S") = ";Y:GOTO 270
290 YH=SGN(A3*H*B*H+A2*H*B+A1*H+A0)
300 YL=SGN(A3*L*B*L+A2*L*B+A1*L+A0)
310 Y=A3*S*S+A2*S*A1+A0:YS=SGN(Y):RETURN

```

End

Program Listing 2. Cubic for the Model III.

```

0 'CUBIC/III VERS 2/15/84 by Mike O'Neal
10 DEF FNA(X)=A3*X*X*X+A2*X*X+A1*X+A0
20 DEF FNB(X)=SGN(FNA(X)):CC=32
30 PRINT "THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS"
40 PRINT "OF THE STANDARD FORM: F(X) = A*X^3 + B*X^2 + C*X + D"
50 INPUT "PLEASE INPUT THE COEFFICIENTS A,B,C,D ";A3,A2,A1,A0
60 PRINT:IFA3<>0,100
70 IFA2<>0,A=A2:B=A1:C=A0:PRINT "THE";:GOTO 190
80 IFA1<>0,50
90 PRINT "THE ONLY ROOT IS X = ";-A0/A1:END
100 'CUBIC
110 S=1:L=0:P=1
120 S=L-S:L=L-L:IF FNB(S)<>FNB(L),140
130 S=-S:L=-L:IF FNB(S)=FNB(L),120
140 H=(S+L)/2:IF FNB(S)<>FNB(H),L=H ELSE S=H
150 IF ABS(L-S)<P,P=ABS(L-S):GOTO 140
160 PRINT "THE FIRST REAL ROOT IS X0 = ";H:PRINT "THE OTHER";
170 'SYNTHETIC DIVISION
180 A=A3:B=H*A+A2:C=H*B+A1
190 'QUADRATIC
200 PRINT " 2 ROOTS ARE "
210 D=B*B-4*A*C:IF D<0,240
220 X1=(-B+SQR(D))/(2*A):X2=(-B-SQR(D))/(2*A)
230 PRINT X1 = ";X1:PRINT X2 = ";X2:GOTO 270
240 PRINT "THE COMPLEX CONJUGATES: ";D=-D
250 XR=-B/(2*A):XI=SQR(D)/ABS(2*A)
260 PRINT XR;CHR$(127);STR$(XI);CHR$(105)
270 S=999999:INPUT "Press <ENTER> to end program. CHECK #";S
280 IF S=999999 THEN ELSE PRINT "F ("S") = ";FNA(S):GOTO 270

```

End

Program Listing 3. Cubic for the Models 4, 1000, 2000.

```

0 'CUBIC/4
10 DEF FNA(X)=A3*X*X*X+A2*X*X+A1*X+A0
20 DEF FNB(X)=SGN(FNA(X)):CC=32
30 PRINT "THIS PROGRAM FINDS ROOTS OF CUBIC EQUATIONS"
40 PRINT "OF THE STANDARD FORM: F(X) = A*X^3 + B*X^2 + C*X + D"
50 INPUT "PLEASE INPUT THE COEFFICIENTS A,B,C,D ";A3,A2,A1,A0
60 PRINT:IFA3<>0 THEN 100
70 IF A2<>0 THEN A=A2:B=A1:C=A0:PRINT "THE";:GOTO 190
80 IF A1<>0 THEN 50
90 PRINT "THE ONLY ROOT IS X = ";-A0/A1:END
100 'CUBIC
110 S=1:L=0:P=1
120 S=L-S:L=L-L:IF FNB(S)<>FNB(L) THEN 140
130 S=-S:L=-L:IF FNB(S)=FNB(L) THEN 120
140 H=(S+L)/2:IF FNB(S)<>FNB(H) THEN L=H ELSE S=H
150 IF ABS(L-S)<P THEN P=ABS(L-S):GOTO 140
160 PRINT "THE FIRST REAL ROOT IS X0 = ";H:PRINT "THE OTHER";
170 'SYNTHETIC DIVISION
180 A=A3:B=H*A+A2:C=H*B+A1
190 'QUADRATIC
200 PRINT " 2 ROOTS ARE "
210 D=B*B-4*A*C:IF D<0 THEN 240
220 X1=(-B+SQR(D))/(2*A):X2=(-B-SQR(D))/(2*A)
230 PRINT X1 = ";X1:PRINT X2 = ";X2:GOTO 270
240 PRINT "THE COMPLEX CONJUGATES: ";D=-D
250 XR=-B/(2*A):XI=SQR(D)/ABS(2*A)
260 PRINT XR;CHR$(127);STR$(XI);CHR$(105)
270 INPUT "CHECK #";S
280 PRINT "F ("S") = ";FNA(S):GOTO 270

```

End

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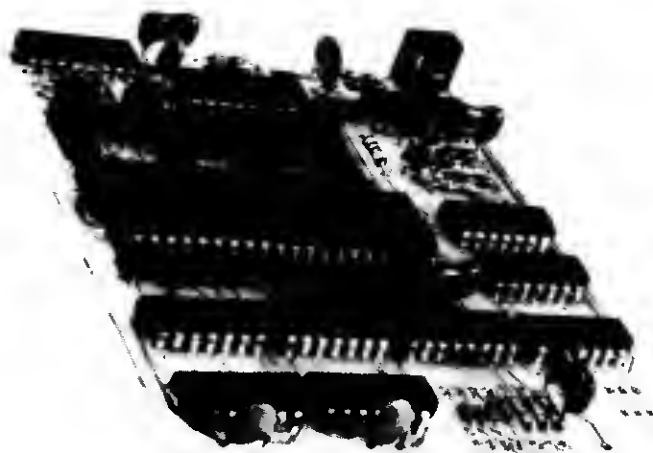
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See opposite page ♦♦♦♦♦

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Desirable Interruptions: A I/III/4 Interrupt Controller

Pardon the interruption...." While interruptions are considered impolite, sometimes you have to make them, especially in microcomputer systems. Many computers, particularly those involved with real-time or time-sharing applications, require microprocessor interrupts to make proper operation possible.

An interrupt allows an external device to have the processor stop what it's doing and take time to service the external device. If the processor isn't doing something more important (determined by a combination of hardware and software), the processor complies with the interrupt. If the processor is working on something more important (a higher-priority device) it ignores the interrupt request and continues with what it was doing.

Many systems (like the TRS-80 Models I, III and 4), use polling for input/output (I/O) operations to see when you've pressed the keyboard or when it's OK to send a character to the printer. Polling is simply a check to see if a device is ready or needs servicing. In a polling system, the processor continually loops to check the status of various devices. This is fine as long as the processor has nothing else to do. But it can often be doing useful work while waiting on I/O devices. Interrupts allow the I/O devices to interrupt the processor when they need service, permitting it to do useful work in the meantime.

This month's project is an interrupt controller compatible with the Models I, III and 4. The controller board uses an 8259A interrupt controller integrated circuit (IC), which does most

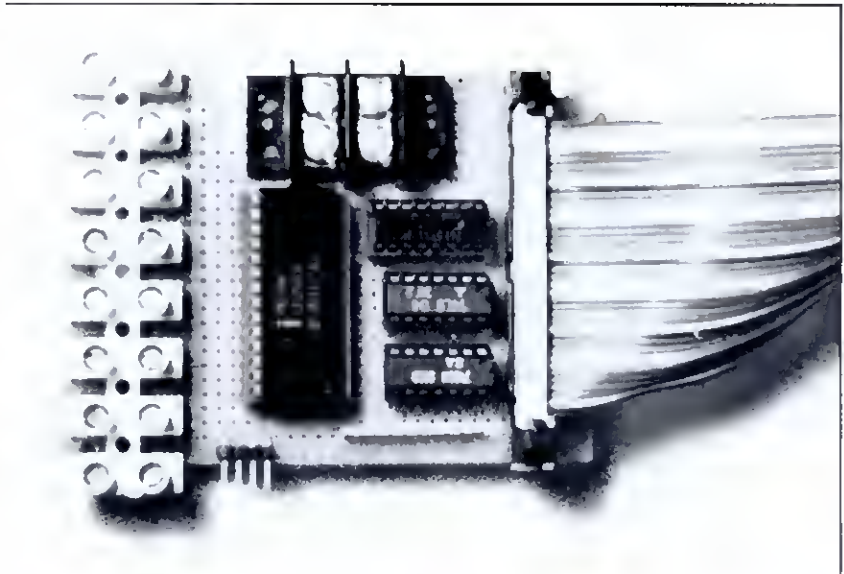


Photo 1. Interrupt controller for Models I, III, and 4.

of the work on the board.

A Look At Z80 Interrupts

The Z80 has two interrupt input lines (INT/ and NMI/) and uses a combination of two signals to acknowledge an interrupt. The INT/ line is the general-purpose interrupt input, the one most commonly used. The NMI/ line, or nonmaskable interrupt line, is reserved for special emergency situations, such as a power failure.

You can enable or disable (mask) the INT/ line under software control, using the Z80's Enable Interrupt (EI) and Disable Interrupt (DI) instructions. This allows the software to determine when to accept interrupts and when not to. The NMI/ input, on the other hand, is nonmaskable, meaning that you can't disable it with software. Because of this, it's rarely used.

The Z80 has three interrupt modes, mode 0, mode 1 and mode 2, which you can use with the INT/ interrupt input. These modes give the Z80 a considerable amount of interrupt flexibility, allowing effective interrupt use in a variety of system applications. I'll

discuss how the Z80 responds to each of the interrupt modes separately, including the best uses for each one.

Z80 Mode 0 Interrupts— 8080A-Compatible Mode

Interrupt mode 0 is the default mode on processor reset. The Z80 responds to its interrupt input in the same manner as its predecessor, the 8080A. The Z80 looks at the interrupt input at the end of each instruction. If it's active (low) and interrupts are enabled, the processor stops its execution and begins servicing the interrupt request. The response will vary depending on the interrupt mode you're using.

In the case of mode 0, the Z80 sends an interrupt-acknowledge signal to the interrupting device when it accepts an interrupt. It does this by simultaneously bringing the MI/ and IORQ/ signals low. The interrupt-acknowledge signal acts as a read strobe to the interrupting device, telling it to put the opcode (first byte) of an instruction on the data bus. This is a Call instruction pushing the processor's program

The Key Box

Models I, III, and 4
16K RAM
Assembly Language
Editor/Assembler



counter (PC) onto the stack and branching the execution to the beginning of the interrupt service routine.

The 8080A (like the Z80) provides a set of 1-byte Call instructions ideal for this purpose. These eight instructions, called Restart instructions, make a call to a predetermined location in memory (usually occupied by ROM). Because of their bit makeup, you can easily generate them with hardware. The instructions to do so, along with the binary code, are shown in Fig. 1, along with the memory addresses to which they call. The underlined bits indicate the only bits that differ among the eight different Restart instructions.

While the Restart instructions are easy to generate and are the most common in 8080A systems, you can put any 8080A instructions (or Z80 instructions for the Z80) on the bus. For greater versatility in where the computer puts the Call Table service routine in memory, interrupt controllers (like the 8259A used in this month's project) are often designed to generate actual 3-byte Call instructions. This way, you could specify an actual 16-bit address in it. For instructions like this, where the number of instruction bytes is greater than one, the CPU will send enough interrupt-acknowledge signals to read in all the bytes necessary.

Mode 0 is primarily used in systems when you want to maintain compatibility with 8080A systems, or when you're using peripherals (such as the 8259A in this month's project) for use with 8080A-type processors. The Z80's flow response to an interrupt in mode zero is shown in Fig. 2.

Z80 Mode 1 Interrupts—Restart 38H

This is the simplest and least flexible interrupt mode the Z80 offers. If an interrupt occurs while you're enabling interrupts, the Z80 merely executes a Restart 38H instruction, which is a Call to memory location 0038 hexadecimal (hex). The Z80 produces no interrupt-acknowledge signal, and requires no external hardware. You use this mode in small systems, where the interrupt requirements are minimal and the external hardware required for the other Z80 interrupt modes is unnecessary. This is the one most often used by TRS-80s. The Model I uses it with its 25ms interrupt and disk controller interrupts, and the Models III

and 4 don't even provide the interrupt-acknowledge signal on their expansion connectors, necessary for the use of the other interrupt modes.

Figure 3 illustrates the Z80's flow response to a mode 1 interrupt.

Z80 Mode 2 Interrupts—Indirect Call

Mode 2 is the most powerful of the Z80 interrupt modes. The Z80 generates an interrupt-acknowledge signal to the interrupting device, and expects a 1-byte vector in response. This vector is actually the low byte of a memory address which, by convention, must be even. The high byte of the address is found in the Z80's Interrupt (I) register, which you must set up with software. The Z80 puts the 2 bytes together to form a 16-bit address in memory, where it then gets the 16-bit address of the interrupt service routine. The I register points to a vector table page in memory, and the input vector byte provides the offset into that table. Since you can program the I register, you can load the vector table virtually anywhere in memory.

Most Z80 peripheral devices support mode 2 interrupts. You can also support it with a little external hardware, in much the same way as mode 0 interrupts. Mode 2 interrupts are used in most Z80 systems that use Z80 peripherals, or that provide the hardware required for the additional flexibility. The Z80's flow response to mode 2 interrupts is shown in Fig. 4.

The Z80 Nonmaskable Interrupt

You can't disable the nonmaskable interrupt. This allows top-priority response from the Z80 in case of a system emergency. When the Z80 responds to a nonmaskable interrupt, it executes a Restart 66H instruction, performing a call to memory location 0066 hex. The Z80 also saves the enable/disable status of the INT/ interrupt before it disables the interrupts for NMI/ servicing (described below). The Z80's flow response to a nonmaskable interrupt is shown in Fig. 5.

Interrupt Flip-Flops

The Z80 has two internal flip-flops for interrupt enabling and disabling. These flip-flops, designated IFF1 and IFF2, work with each other to provide the interrupt enable/disable flexibility, as well as temporary enable status storage during servicing of nonmask-

able interrupts. On reset, the Z80 clears both IFF1 and IFF2, preventing maskable interrupts (INT/) from being accepted. When it executes an EI instruction, the Z80 sets both flip-flops, allowing it to accept maskable interrupts. The two flip-flops follow each other most of the time.

When a nonmaskable interrupt occurs, the Z80 saves the current state of

Restart Instruction	Bit Pattern	Call Address
RST 00H	11000111	0000H
RST 08H	11001111	0008H
RST 10H	11010111	0010H
RST 18H	11011111	0018H
RST 20H	11100111	0020H
RST 28H	11101111	0028H
RST 30H	11110111	0030H
RST 38H	11111111	0038H

Figure 1. Restart Instructions.

1. Interrupt occurs.
2. Disable further interrupts.
3. Assert acknowledge.
4. Read byte op-code on data bus.
5. More bytes to come? If yes, then 4.
6. Execute instruction received from interrupting device.

Figure 2. Mode 0 interrupt response.

1. Interrupt occurs.
2. Disable further interrupts.
3. Call memory location 0038H.

Figure 3. Mode 1 interrupt response.

1. Interrupt occurs.
2. Disable further interrupts.
3. Assert acknowledge.
4. Get vector on data bus.
5. Combine vector with I-register value to form address of service routine.
6. Get service routine address and call the service routine.

Figure 4. Mode 2 interrupt response.

1. Interrupt response.
2. Maskable interrupt status is saved.
3. Maskable interrupts are disabled.
4. Call location 0066H.
5. Restore maskable interrupt enable status when done.

Figure 5. NMI response.

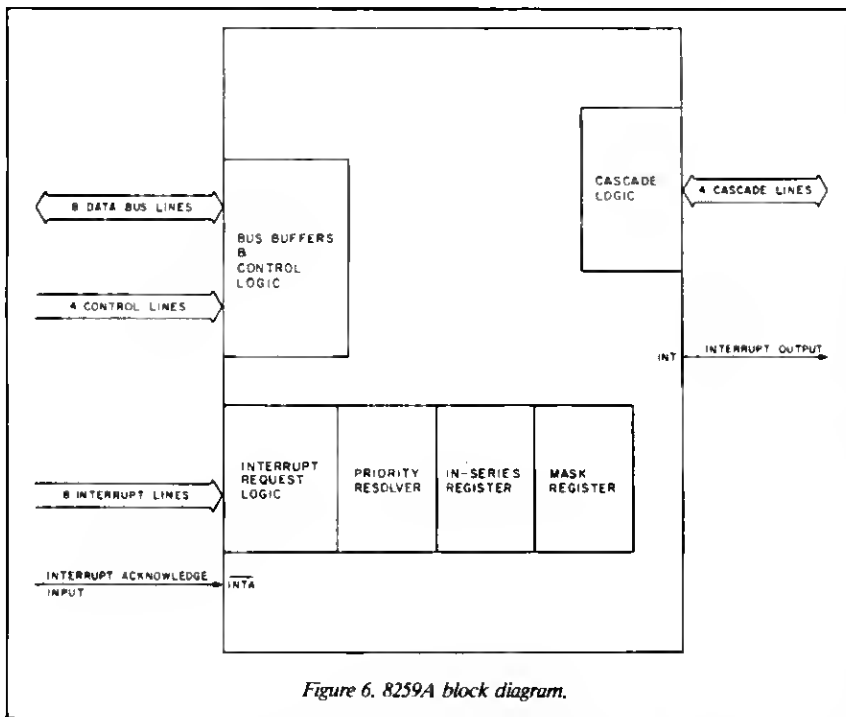


Figure 6. 8259A block diagram.

IFF1 in IFF2, while it clears IFF1 to make sure no maskable interrupts occur while processing the nonmaskable interrupt. When the Z80 executes the RETN (return from nonmaskable interrupt), it transfers the value in IFF2 to IFF1, restoring its original, pre-interrupt value.

Levels and Edges

Different processors have different ways of determining the validity of an incoming interrupt request. The Z80, for instance, looks for a low level on its INT/ line. When the line is low, the

Z80 assumes that the connected device is requesting an interrupt. Some processors, like the 8085A, look for a high level. When the line is high, the processor assumes that the connected device is requesting an interrupt. Others look for an edge trigger. They expect to see a rising edge or falling edge of a signal for a valid interrupt request. Some even require a combination of an edge and a level.

Each of these triggering modes has its advantages and disadvantages. The level-triggered mode is the most common, and assumes that whenever a de-

vice has its interrupt line at a certain level (either high or low, depending on the processor), it needs servicing. During the service routine, the processor performs whatever operations are necessary for the device to deactivate its interrupt request, before the processor reenables the interrupts.

The edge-triggered mode assumes that a device will activate its interrupt line when it needs service, making the necessary edge trigger, but may not deactivate the line level until some later time. In this case, it is not desirable for the CPU to keep seeing the line as an active interrupt and attempting to service it.

For example, say an interrupt input is positive edge-triggered, meaning that it is triggered by a low-to-high voltage transition. The transition notifies the CPU that a device is requesting an interrupt so the CPU can service the interrupt. At the end of the interrupt service routine (ISR), the CPU reenables interrupts, but the interrupt line is still high. A CPU with a level-triggered input would immediately see the high line as another interrupt request and service the interrupt. The edge-triggered CPU, however, would not recognize another interrupt request until the line returned low, then went high again.

The third type of triggering, a combination of edge- and level-triggering, is often used for nonmaskable interrupt inputs, or in systems with noisy environments. The CPU only checks the interrupt lines between instructions (actually at the end of each instruction). If a low-to-high transition occurs on the line, the CPU sets an internal flip-flop to record the edge. Then, when the time comes to check for an interrupt, the CPU looks for both an active flip-flop, indicating the edge has occurred, and an active (high) input. If both of these conditions are not true, no interrupt service processing will take place.

The advantage of looking for both conditions is two-fold. First, if a glitch (voltage spike) occurs and sets the flip-flop, it will not cause a nonmaskable interrupt, since the line probably won't still be high when the CPU checks it. Second, if a nonmaskable interrupt does occur, the CPU won't recognize another nonmaskable interrupt until the line returns low, then goes high again. The benefits of level-

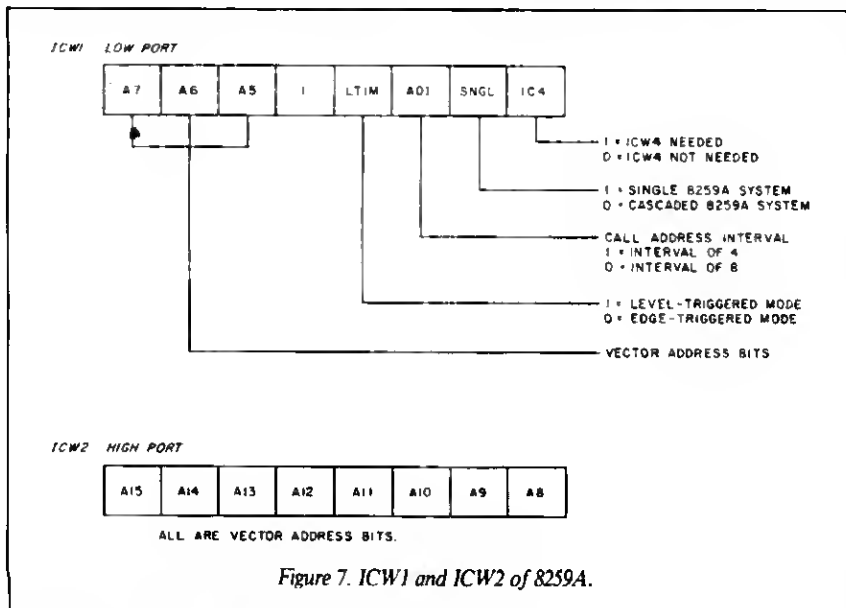


Figure 7. ICW1 and ICW2 of 8259A.

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PRINT @	•	•	•
INPUT/LINE INPUT	•	•	•
INPUT #/LINE INPUT #	•	•	•
READ #/READ # LINE	•	•	•
LOC/LOF/EOF/ERROR	•	•	•
FIELD/GET/PUT	•	•	•
RSET/LSET/ERASE	•	•	•
MKDS/MKIS/MKSS	•	•	•
CVI/CVS/CVD/SPC	•	•	•
READ/DATA/RESTORE	•	•	•
TRON/TROFF	•	•	•
DEF FN/RANDOM/RNO	•	•	•
DEF USR/SWAP/WAIT	•	•	•
CALL (ASSEMBLY LANG)	•	•	•
DEFSTR/DBL/SNG/INT	•	•	•
DOUBLE/REAL	•	•	•
INTEGER/STRING	•	•	•
GOTO/GOSUB	•	•	•
ON ERROR GOTO	•	•	•
RESUME/RESUME NEXT	•	•	•
ERL/ERR	•	•	•
ON number GOTO/GOSUB	•	•	•
NAME/RENAME	•	•	•
PEEK/POKE/INP/OUT	•	•	•
SYSTEM/SOUND	•	•	•
SADO/MATCH/UCASE\$	•	•	•
VAL/TAB/STR\$/VARPTR	•	•	•
SIN/COS/TAN/ATN	•	•	•
LOG/EXP/ABS/SQR	•	•	•
COMMANDS/IF END	•	•	•
INKEYS/INPUTS	•	•	•
TIMES/DATES/HEXS/OCTS	•	•	•
STRINGS/SPACES	•	•	•
LEFTS/RIGHTS/MIDS	•	•	•
CHR\$/ASC/LEN/SGN	•	•	•
OPTION BASE	•	•	•
RDW/POS/LPOS	•	•	•
DIM/MEM/FRE	•	•	•
MOQ/MFRE	•	•	•
GET/PUT (CHARACTER)	•	•	•
KILL/CLS/CLEAR/INSTR	•	•	•
INT/FIX/CINT	•	•	•
CSNG/CDBL	•	•	•
CNAIN	•	•	•
CONST%/CONCHAR%	•	•	•
CONSOLE/LPRINTER	•	•	•
BINARY RANDOM FILES	•	•	•
ASCII RANDOM FILES	•	•	•
255 CHARACTER NAMES	•	•	•
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UNLIMITED STRING SIZE	•	•	•
MULTI-LINE FUNCTIONS	•	•	•
PROCEDURES/RECURSION	•	•	•
FUNCTION TRACING	•	•	•
LOCAL VARIABLES	•	•	•
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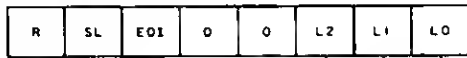
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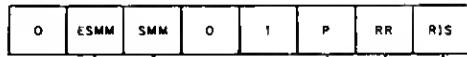
215

OCW2 LOW ADDRESS



INTERRUPT LEVEL IF
USING A SPECIFIC EO1
SPECIFY EO1
OR PRIORITY ROTATION

OCW3 LOW ADDRESS



USED TO READ ISR
OR IRR
1 = POLL COMMAND
0 = NO POLL COMMAND
USED TO SELECT A
SPECIAL MASK MODE

Figure 8. OCW1 and OCW3 of 8259A.

triggering and edge-triggering are combined for a double-safe interrupt input.

The 8259A Programmable Interrupt Controller

The 8259A programmable interrupt controller (PIC), developed by Intel, is a versatile device that provides eight interrupt inputs and a full 3-byte call to the CPU for versatility in locating the interrupt jump table in memory. The basic block diagram of the 8259A is shown in Fig. 6. An 8-bit bus interface handles communication with the CPU and one interrupt output to the CPU. The 8259A takes up two locations in I/O addressing space.

The 8259A provides several features that make it useful for a variety of applications. The eight interrupt inputs are prioritized, allowing higher-priority devices to interrupt lower-priority devices, but not the other way

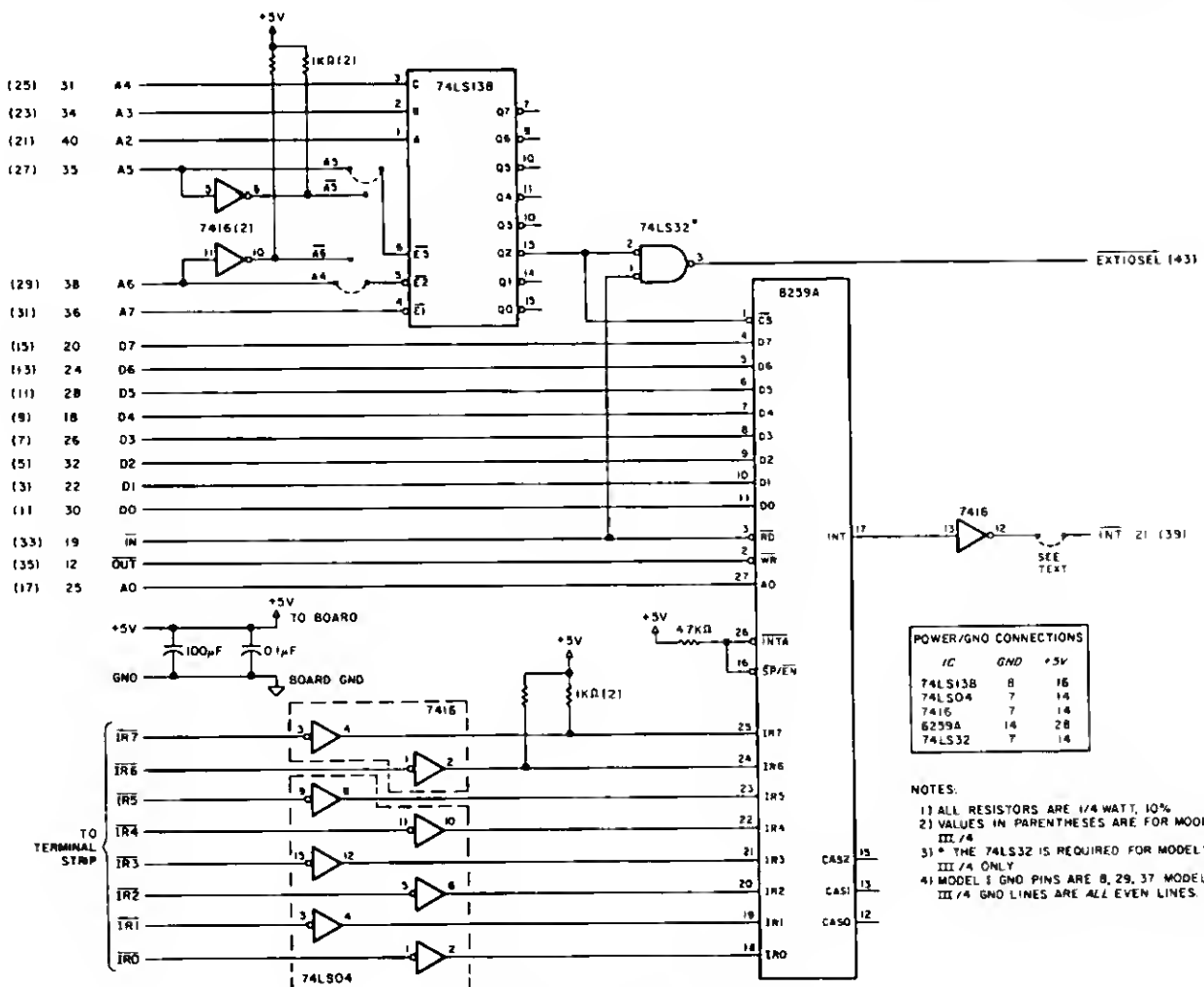


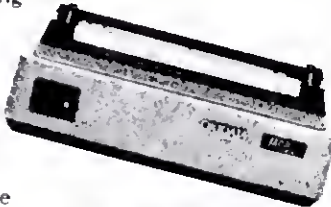
Figure 9. Interrupt controller board.

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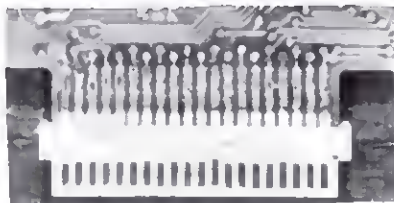
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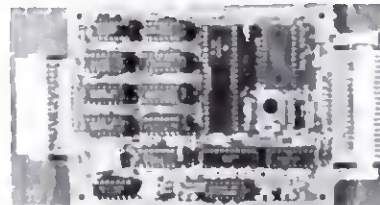
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around. You can program the inputs as level-triggered or edge-triggered, and you can selectively mask (enable or disable) them. You can cascade up to nine 8259A's together, providing up to 64 prioritized interrupt levels.

The CPU can send two kinds of command words to the 8259A: Initialization command words (ICWs) and operation command words (OCWs).

shown in Fig. 7. While two are shown, you'll use only the first, although you must still send both to the 8259A to meet initialization requirements.

The default mode setting for the 8259A is for 8080A mode, which is what you want. You can also program it to work with the 8086/8088 family of processors. Bit 0 of ICW1 specifies whether or not ICW4 will or won't be

cleared bits enable the corresponding inputs.

The formats for OCW2 and OCW3 are shown in Fig. 8. I'll describe the functions of these operation command words later, when I discuss the operation of the interrupt controller board.

Building the Interrupt Controller Board

The parts list for the interrupt controller board (as well as the general-purpose I/O board addition) is shown in Table 1, and the schematic is shown in Fig. 9. Some of the parts are optional, depending on what you actually want to build (described in the remainder of this article). The interrupt controller board is shown in Photo 1. The photo does not include the recommended additional reset circuitry described below.

Building the controller board is simple and straightforward. You need only a few easily obtained ICs, along with a handful of passive components. The addressing for the 8259A is jumper selectable, near the 74LS138. The jumper settings I used are indicated by dotted lines on the schematic (the programs described later will assume this addressing). The possible addressing for the device is as follows:

E2	E3	Addressing Range
A6/	A5/	48-4B hex
A6/	A5	68-6B hex
A6	A5/	08-0B hex
A6	A5	28-2B hex (my choice)

Although the hardware reserves four port locations for each jumper setting, the 8259A requires only two. It is double addressed within the port addressing range. That is, the device will appear in the lower two or upper two locations of the chosen addressing range. The convention for such a situation is to use the lower addresses of the addressing range. I will use addresses 28 hex and 29 hex in the programs described later.

Because the 8259A doesn't have internal reset circuitry, the state of its interrupt output line (pin 17) is unknown at power-up. If this is connected (via the 7416 gate) to the TRS-80 interrupt input line at system power-up, a problem will exist if the interrupt is active. This may not be a problem with the Models III and 4 since they have an internal register to enable ex-

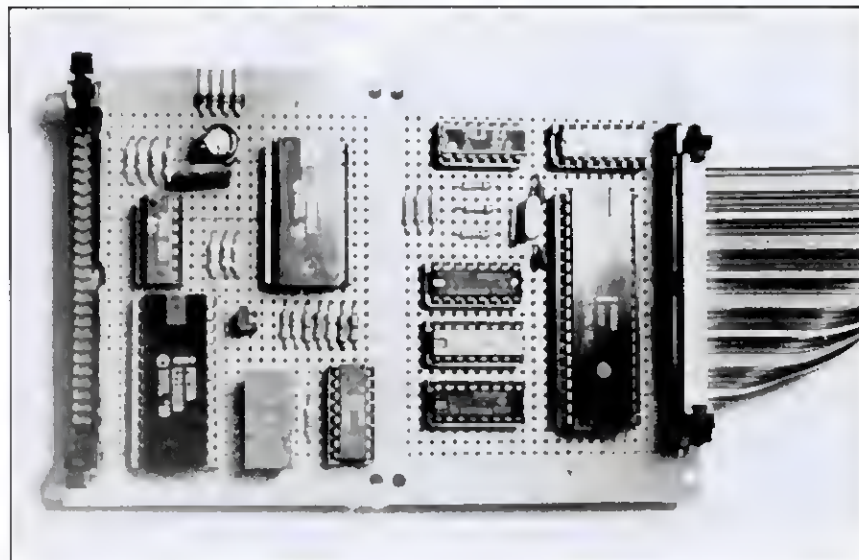


Photo 2. General-purpose I/O board with interrupt controller.

The CPU sends the ICWs only once to initialize the 8259A after power-up. It sends the OCWs at various times as required to perform different operations. OCWs can alter interrupt masks, change priority levels, acknowledge interrupts, and more.

While you have four defined ICWs available, the interrupt controller board will use only two, described here. You'll use all three of the defined OCWs, since they provide the real flexibility in operation.

The interrupt controller is primarily designed to generate a 3-byte call instruction to the CPU when a device requests an interrupt, and the CPU responds with an interrupt acknowledge. Since TRS-80s aren't well-designed for this type of interrupt response (particularly the Models III and 4) you won't use that feature; instead, you'll use its polled mode operation capability.

When you apply power to the 8259A, the state of the device, including its interrupt output line, is unknown, since no reset input is available. Before you use the device, you must initialize it with the ICWs. The two ICWs you'll use are

sent. Since ICW4 specifies optional parameters you won't use, this bit is programmed with a zero. Bit 1 distinguishes whether the chip is by itself or if other PICs are cascaded with it. This bit is programmed as a 1 in our system, since it's by itself. Bit 2 relates to the spacing of service routine call addresses in normal operation, and doesn't apply to our system.

Bit 3 of ICW1 determines whether the inputs will look for level-triggered interrupts (1) or edge-triggered interrupts (0). I will use level-triggered interrupts in my examples, but use whatever meets your needs. Bit 4 must be a 1 to indicate that you're sending ICW1. Bits 5-7 of ICW1 and all of ICW2 provide address bits for the call addresses generated during normal operation. These don't apply to your system either.

Once you initialize the 8259A, you can selectively enable or disable the various interrupt inputs by writing a mask byte (OCW1) to the higher 8259A port (port 29 hex on your board). Any bit that is set masks (disables) the corresponding interrupt input, and

PROJECT 80

ternal interrupts. I presume (though I am not certain) the initialization software in the TRS-80 disables external interrupts, making it necessary for applications software to enable external interrupts before the CPU accepts interrupts. If this is true, the optional reset circuitry described below is unnecessary. In any case, the optional circuitry can't hurt, and I recommend it at least for all Model I users.

The reason the jumper is shown on the schematic (on the interrupt line going to the TRS-80) is in case you don't want to add the optional reset circuitry, or for some reason don't want the interrupt on the TRS-80's interrupt line. You may not need the jumper in your application. You'll also need a +5V @150mA (milliamps).

The interrupt inputs to the 8259A have inverters on them. The inputs to these inverters can then be connected to a terminal strip to provide you with eight active low interrupt inputs.

Building the General-Purpose I/O Board Addition

In December's Project 80, I described the construction of a general-purpose I/O board. An interrupt controller would be a valuable addition, so I've provided the schematic for it (see Fig. 10). The parts list is in Table 1, as it is for the stand-alone interrupt controller board described above. The general-purpose I/O board with the interrupt circuitry is shown in Photo 2.

The construction of this addition is straightforward. You address (chip select) the 8259A from an unused pin on the 74LS138 (pin 13). This gives you the same addressing range as for the stand-alone controller board described above, 28-2B hex. The general-purpose I/O board already has two major peripheral devices, and they're designed to provide interrupts to the CPU during various modes of operation. The five possible interrupt pins (two from the 8255A and three from the 8253/4) are connected to the first five interrupt inputs on the 8259A. This allows selective interrupt inputs under software control.

You could use this, for example, to generate an interrupt to the CPU at predetermined points in time, and update something during the interrupt service routine. I'll illustrate this in the programs described later. This also allows the 8255A to generate interrupts

to the Z80 after certain handshaking operations. (I used the same concept in the printer buffer project described in the September/October 1984 Project 80, p. 102 and p. 146.)

I used five inputs to the 8259A, with three unused. I put inverters at these inputs, to make available three general-purpose active low interrupts.

The Optional Reset Circuitry

The schematic for the optional reset circuitry is shown in Fig. 11. The parts are listed in Table 1, along with the other project parts. The reset circuitry provides a function available on many peripheral devices, and would probably have been put on the 8259A if an extra pin were available.

The reset circuitry is very simple, and requires the addition of only a 74LS74 dual D-type flip-flop and a 74LS32 quad OR-gate (Models III and 4 users may use spare 74LS32 gates from the EXTIOSEL/ circuitry), and a couple of resistors. The interrupt output that was to go to the TRS-80 INT/ line (pin 12 of the 7416) is routed instead to pin 9 of the 74LS32. The TRS-80 RESET/ output line then goes to pin 1 of the 74LS74, the reset line on the first flip-flop. For this to work, you must turn on the interrupt controller before or simultaneous with the TRS-80, so that it can see the TRS-80's power-up RESET/ signal.

Pins 13 and 12 of the 74LS32 connect to the chip select (CS/) and write (WR/) lines on the 8259A, respectively. This creates an active (low) output signal when both input signals are active (low). This creates the necessary clock input to the 74LS74 when the 8259A is written to.

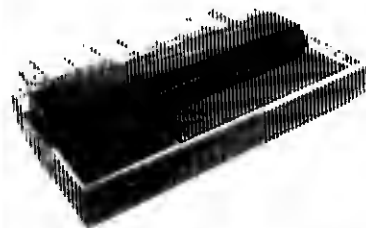
Look at how this circuit works. When you reset the TRS-80, the Q/ (Q not) output of the 74LS74 (pin 6) goes high. This makes the output (pin 8) of the connected OR-gate high, regardless of the other gate input. The second 74LS74 flip-flop is then used as an inverter, to create a low level on its Q (pin 9) output. This then goes to the 7416 gate to get re-inverted to a high level, an inactive interrupt level.

When the computer first writes to the 8259A, however, the clock input (pin 3) to the first flip-flop makes the D-input value (high) appear on the Q output, and the inversion of that to appear on the Q/ output. The low level on Q/ enables the connected 74LS32,

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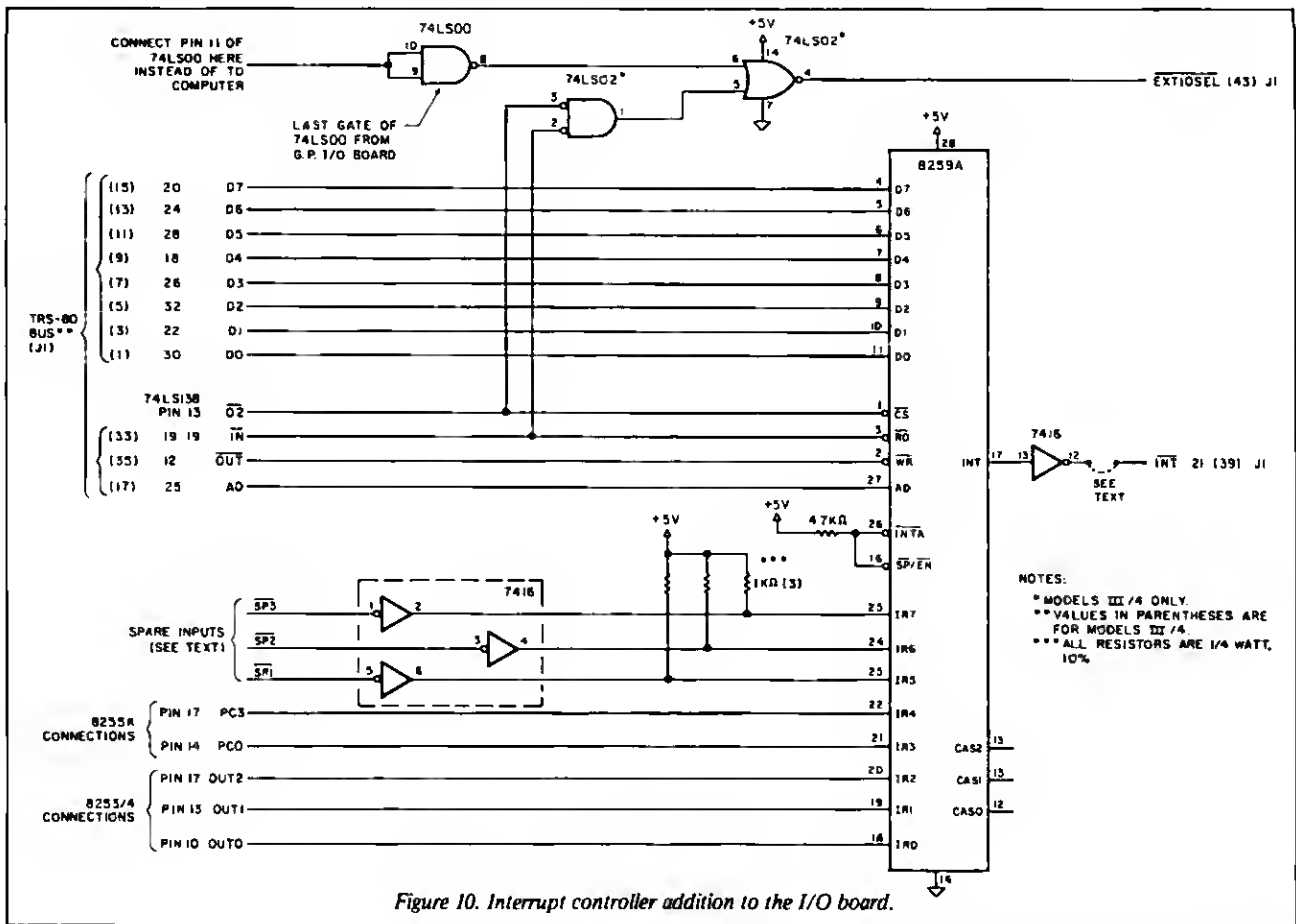


Figure 10. Interrupt controller addition to the I/O board.

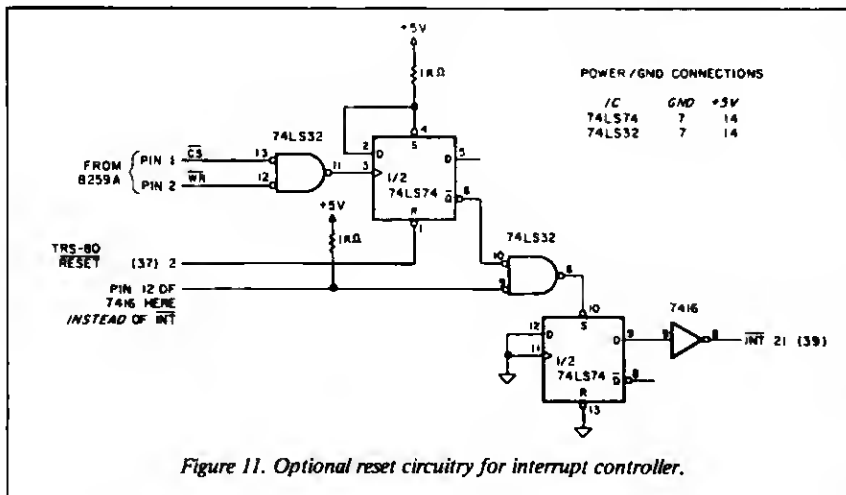


Figure 11. Optional reset circuitry for interrupt controller.

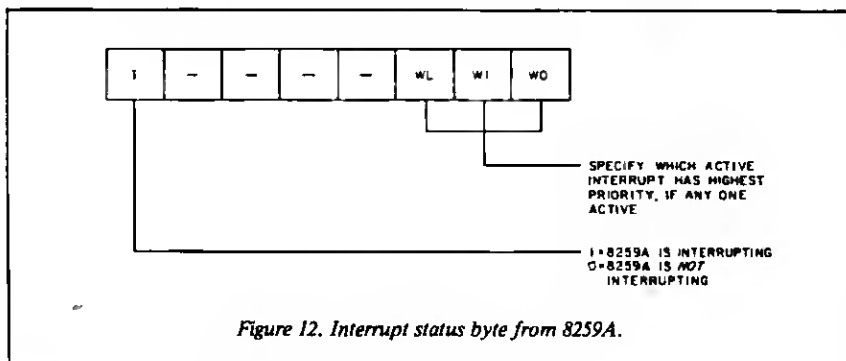


Figure 12. Interrupt status byte from 8259A.

which transfers the interrupt level on its pin 9 input to its pin 8 output, and, after two further inversions, is finally placed on the TRS-80's interrupt line. The interrupt output from the 8259A to the TRS-80's interrupt line will, then, always be enabled until it receives another reset signal. The reason for the double inversion (using the second flip-flop and the 7416) is because of the need to use the open collector 7416 gate, described below.

Operating the Interrupt Controller

This section concerns both the stand-alone controller board, as well as the general-purpose I/O board addition, since both operate identically. One of the essential requirements of the interface to the Model 1 bus is to use an open collector driver. Open collector drivers, like the 7416 inverting drivers, don't have the collectors on their output transistors pulled up, as do standard transistor-to-transistor logic ICs. This lets you tie any open-collector outputs together with a common pull-up resistor. The net effect is that, when all the outputs are high, the line is high. When any one of them goes

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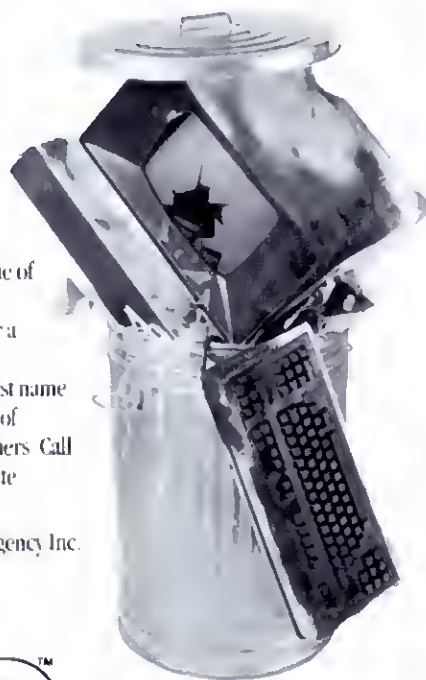
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Program Listing. Demonstration for Model III/4 to illustrate the use of the 8259A interrupt controller with the December Project 80 general-purpose I/O board.

```

00100 ;*****
00110 ; This is a demonstration program for the Model III/4 to
00120 ; illustrate the use of the 8259A interrupt controller
00130 ; with the Project 80 G.P. I/O board. It sets up the
00140 ; various board devices to increment the LED display
00150 ; every second. See column text for a more-indepth
00160 ; description.
00170 ;
00180 ; Written by Roger C. Alford
00190 ;*****
00200 ;
00210 ;
00220 ;PPICMD EQU 23H ;8255A COMMAND PORT
00230 ;PPIB EQU 21H ;8255A PORT B
00240 ;PICPB EQU 28H ;LOWER PORT OF 8259A
00250 ;PICPI EQU 29H ;UPPER PORT OF 8259A
00260 ;PITCAD EQU 27H ;8253 COMMAND PORT
00270 ;PITB EQU 24H ;TIMER 0 PORT ON 8253
00280 ;TRSEXE EQU 80H ;TRS-80 EXTERNAL I/O ACCESS PORT
00290 ;TRSINT EQU 80H ;TRS-80 INT. ENABLE PORT
00300 ;TRSRDI EQU 80H ;TRS-80 READ INT. STATUS PORT
00310 ;
00320 ; ORG 7000H ;SAFE ADDR FOR ALL NEN SIZES
00330 ;
00340 ;VARIABLES USED:
00350 ;INTTBL DEFN TIMERS ;TIMER 0 INTERRUPT
00360 ;BADINT DEFN ;INVALID INTERRUPT
00370 ;BADINT DEFN ;INVALID INTERRUPT
00380 ;BADINT DEFN ;INVALID INTERRUPT
00390 ;BADINT DEFN ;INVALID INTERRUPT
00400 ;BADINT DEFN ;INVALID INTERRUPT
00410 ;BADINT DEFN ;INVALID INTERRUPT
00420 ;BADINT DEFN ;INVALID INTERRUPT
00430 ;
00440 ;PPIBYT DEFS 1 ;STORAGE FOR 8255 PORT B BYTE
00450 ;TIMCNT DEFS 1 ;STORAGE FOR INTERRUPT COUNTER
00460 ;VECTOR DEFS 2 ;STORAGE FOR TRS-80 ISR ADDRESS
00470 ;
00480 ;
00490 ;INTTBL DI ;DISABLE Z80 INTERRUPTS
00500 ; FOR INITIALIZATION.
00510 ;LD A,10H ;WRITE BYTE TO ENABLE
00520 ;DUT (TRSEXE),A ;EXTERNAL I/O ACCESS
00530 ;LD A,10H ;GET 8259A ICW1 -- SINGLE
00540 ; CONTROLLER SYSTEM,
00550 ; LEVEL-TRIGGERED.
00560 ;OUT (PICPB),A ;SEND TO 8259A
00570 ;XOR A ;ZERO THE ACCUMULATOR
00580 ;OUT (PICPI),A ;WRITE ICW2 -- NOT REALLY
00590 ; USED HERE.
00600 ;LD A,0FEH ;GET INT. MASK BYTE
00610 ;OUT (PICPI),A ;ENABLE TIMER 0 INT.
00620 ;LD A,99H ;SET 8255A PORT B FOR
00630 ; OUTPUT MODE 0.
00640 ;OUT (PPICMD),A ;SEND TO 8255A COMMAND PRT
00650 ;LD A,03H ;SET LED TO '0' AND
00660 ; TIMER 0 FREQ.=250 KHz.
00670 ;OUT (PPIB),A ;SEND TO 8255A PORT B
00680 ;LD (PPIBYT),A ;SAVE VALUE ALSO IN MEM.
00690 ;LD A,30H ;GET 8253 COMMAND BYTE --
00700 ; SET TIMER 0 TO MODE 0
00710 ;OUT (PITCAD),A ;SEND TO 8253 COMMAND PRT
00720 ;LD A,24H ;GET LOW COUNT BYTE
00730 ;OUT (PITB),A ;SEND TO TIMER 0
00740 ;LD A,0F4H ;GET BIG COUNT BYTE
00750 ;OUT (PITB),A ;SEND TO TIMER 0
00760 ;
00770 ;XOR A ;CLEAR THE ACCUMULATOR
00780 ;LD (TIMCNT),A ;CLEAR THE INT. COUNTER
00790 ;LD A,(4012H) ;SEE IF ISR ALREADY THERE
00800 ;CP 0C9H ;LOOK FOR A RETURN
00810 ;JR Z,NOISR ;IF YES, NO ISR IN SYS.
00820 ;LD HL,(4013H) ;ELSE, GET ISR ADDRESS
00830 ;LD (VECTOR),HL ;SAVE IN VECTOR LOCATION
00840 ;JR INITDN ;FINISH INIT.
00850 ;LD HL,NOPROC ;GET ADDR FOR NO PROCESS
00860 ;LD (VECTOR),HL ;PUT IT INTO VECTOR
00870 ;LD A,0C3B ;GET JUMP OPCODE BYTE
00880 ;LD (4012H),A ;WRITE TO TRS-80 VECTOR
00890 ;TO INSURE IT'S THERE
00900 ;LD HL,SERVIC ;GET ADDRESS OF OUR ISR
00910 ;LD (4013H),HL ;SAVE IN TRS-80 VECTOR
00920 ;LD A,00H ;WRITE BYTE TO ENABLE
00930 ;OUT (TRSRDI),A ;EXTERNAL I/O INTS.
00940 ;EI ;ENABLE INTERRUPTS NOW
00950 ;LOOP JR LOOP ;LOOP FOREVER -- JUST
00960 ; HAPPEN.
00970 ;
00980 ;
00990 ;*****
01000 ; This is the interrupt service routine (ISR)
01010 ; processing code. If the interrupt belongs to the
01020 ; 8259A, it will be processed here. Otherwise, it will
01030 ; be forwarded to the TRS-80.
01040 ;*****
01050 ;
01060 ;SERVIC PUSH AP ;SAVE USED REGISTERS ON

```

Listing continued on p. 162

low, the line goes low. This is called a wired-OR configuration.

Open collector drivers allow many devices to share the common interrupt line to the CPU. The CPU must, however, have some way to determine what is requesting any given interrupt. While Model I's require the use of open collector drivers, Models III and 4 users could get by with using a 74LS04 instead of the 7416 chip described above, since open-collector drivers aren't required on the external I/O bus. It is, however, recommended that you use the 7416 because it's a better driver and it lets you parallel other devices that use the interrupt line on the bus in the future. The pull-up for the 7416 is internal to the Models III and 4, as well as to the Model I.

As mentioned during the discussion of the 8259A, the operation command words let you set up most of the various options the 8259A allows. I've developed a program for the Models III and 4 that illustrates the use of the 8259A (see the Program Listing). The program uses the functions of the general-purpose I/O board, but should give you an understanding of the operation of the interrupt controller even if you only build the stand-alone interrupt controller board.

You first set up the 8259A by sending the two ICWs, as well as the interrupt mask (the port addressing is important to note). The interrupt mask sent to the 8259A is 0FEH, only enabling interrupt input 0, which is the output of Timer 0 on the 8253. The 8255A is then set up to permit control of the programmable divided clock to the 8253, as well as the LED display. The display is initialized with a 0. The original 8255A value is also stored in a memory location (PPIBYT) for later reference (during the ISR). Another memory location (TIMCNT) is also cleared, to be used as a count register.

Timer 0 of the 8253 is now set up to operate in mode 0 (interrupt on terminal count), which causes the output of the timer to initially go low, but then go high when the count reaches zero. The frequency input to Timer 0, as established by the 8255A, is 250 KHz, the slowest possible frequency. Assuming we would like to update the LED display once each second, the interrupt to the CPU must occur at a frequency that will easily multiply to

Continued on page 162

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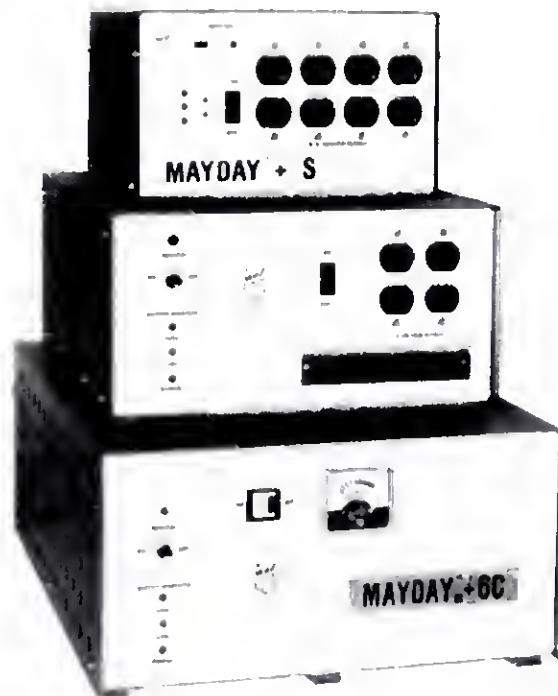
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Getting the Message Across

One of the most important functions of a BBS is its ability to search and find information. Successful BBSes can locate information accurately and efficiently. This month's BBS Express concentrates on finding messages both in memory and on disk.

While it's faster to locate information in memory than on disk, memory space is more limited, which in turn limits the amount of information you can keep in memory. A message header, for example, consists of the message number, subject, date, time, section number, name of sender, and destination. Ideally, all this information should be in memory so you can locate a message quickly. This information requires a total of 92 bytes for each header, or 9.2K of memory if there are 100 messages on board. Unfortunately, however, that's a lot of memory.

To complicate matters further, this header information is in string form, which can easily trigger string garbage collection. The message number, however, isn't in string form. An acceptable solution, then, is to create a fast, in-memory search for the message number, leaving all other searches as disk operations. Because the message numbers are stored economically, memory isn't heavily taxed.

Storing the Message Number

Your computer's memory stores integers in Z80 least significant byte/most significant byte (LSB/MSB) format. Each integer requires 2 bytes: The first byte contains the least significant byte, while the second byte contains the most significant byte. In message number 256, for example, the least significant byte is 0, and the most significant byte is 1. The VARPTR command returns the address where the BBS stores the least significant byte; it stores the most significant byte in the next position.

Using this information, you build an in-memory index of the message



Illustration by Roy Lewando

numbers that you access with a short machine-language code (see Program Listing 1). The index is simply a string that contains the message numbers in sequential order, making it easy to search for any given message number. The VARPTR (string variable) returns the memory address of a pointer that contains both the length of the string and the memory address of the string's first character. Because this information is all part of the same string, it's easily written to disk.

Now you need to convert the message numbers to and from the Z80 LSB/MSB format. Disk Basic does this: It contains MKIS, which returns a 2-byte string in LSB/MSB format, and CVI, which takes that string and returns a number. In the case of message number 256, $MKIS(256) = CHR\$(0) + CHR\(1) ; $CVI(CHR\$(0) + CHR\$(1)) = 256$. Each time a user leaves a message, the BBS writes MKIS (message number) to the in-memory string. The BBS stores the header for the Nth message in record N, and finds it in the index string at position $2*N - 1$. If P is the position in the string, and RN

is the record number of the header for the message, then

$$RN = (P + 1) / 2$$

$$P = (2 * RN) - 1$$

Program Listing 1, in Assembly language, searches the index for the message number. With this message number, you have access to the header, which gives you the secret file name of the text of the message. Label FSRCH calls the PARAM routine which places the length of the string passed from Basic in the B register, and the address of the string's first character in the HL register pair. Basic POKES the message number that you're looking for in SEARCH + 1.

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The BBS then loads this value into the DE pair, transfers the address of the first character in the string to the IX register with the PUSH HL, POP IX instructions, and loads C with 255 to act as a counter.

The BBS loads HL with the value that's located in the first two positions of the string. C is bumped twice, changing its value to 1. Because deleted messages are marked by being set to a negative value (your computer uses 2's complement notation), if bit 7 of the value in the H register is a 1, it's negative and thus ignored as a killed record.

If the number in this position isn't negative, it's compared with the value

If the message numbers exceed the limit, the BBS removes all deleted messages and text files.

that we're searching for by the RST 18H instructions. In effect, RST 18H, in 1 byte, subtracts the contents of the

DE register pair from the contents of the HL register pair, ignoring the result yet saving the flag status.

If the RST 18H command sets the zero flag, the BBS has found the message number. But if the Carry flag isn't set, you've gone too far. In either event, the BBS increments the C counter by 1, then divides it by 2 by shifting it one position to the right (SRL C), placing zero in the B register, and moving BC to HL to pass to Basic.

If the message number is still unknown, the BBS bumps IX, to point to the next pair of characters, decrements B, and initiates DJNZ, looping to FSR010 until done. The JP BASIC instruction passes the value in the HL register (the record number that we're seeking) to Basic.

Program Listing 2 shows how Basic interfaces with the code in Program Listing 1. Basic defines FD as the address of SEARCH+1. Line 430 POKes the LSB of the number that you're searching for into SEARCH+1, and the MSB into SEARCH+2. A call to USR3 returns S equal to either the record number you want or to the next-highest record number.

Lines 2730-2840 make up the close-out routine. This is done first by compressing the number of messages on the board so they don't exceed the maximum set by the sysop. If you're under the limit, write the index back to disk. If, however, the message numbers exceed the limit, the BBS removes all deleted messages and text files. Any excess messages are removed with NW\$, a new index string. This new index starts removing messages at the high end of MN\$ until NW\$ is equal to 2*MX, the maximum number of messages the sysop allows. Everything below that point gets killed, and NW\$ is written to disk. ■

Program Listing 1. BBS code that locates message numbers.

```
01740 ;      SEARCH FORWARD FOR SPECIFIED 2-BYTE STRING
01750 ;
01760 FSRCH  CALL  PARAM      ;GET VARPTR(MN$)
01770 SEARCH LD    DE,0000    ;SEARCH STRING
01780        PUSH  HL
01790        POP   IX
01800        LD    C,255      ;STR. POS. COUNTER
01810 FSR010 LD    L,(IX+0)
01820        LD    H,(IX+1)   ;GET FIRST PAIR FOR
CMPR
01830        INC    C
01840        INC    C          ;BUMP STRNG POINTER
01850        BIT    7,H        ;CHECK FOR NEGATIVE
01860        JR     NZ,REVR    ;NEGATIVE - DEAD FILE
01870        RST    18H       ;COMPARE HL/DE
01880        JR     Z,FSR100   ;FOUND
01890        JR     NC,FSR100  ;TARGET>SOURCE
01900 REVR   INC    IX
01910        INC    IX
01920        DEC    B
01930        DJNZ  FSR010     ;LOOP TIL FOUND
01940 FSR100 INC    C          ;STRPOS+1
01950        SRL    C          ;(STRPOS+1)/2
01960        LD    B,0
01970        PUSH  HC
01980        POP   HL
01990        JP    BASIC      ;PASS TO BASIC
```

End

Program Listing 2. BBS code to interface Program Listing 1 with Basic.

```
430 POKE FD+1,INT(MN/256):POKE FD,MN-(INT(MN/256)*256):
S=USR3(VARPTR(MN$)):RETURN
2730 IF (SN=0) OR (LEN(MN$)=0) THEN SL=0:SH=0:SN=0:NW$="":
GOTO 2820
2740 FOR S=LEN(MN$)-1 TO 1 STEP-2:MN=CVI(MID$(MN$,S,2))
2750 IF (LEN(NW$)<2*MX) AND (MN>0) THEN
NW$=MID$(MN$,S,2)+NW$:PS=CHR$(INT((S+1)/2)):PS:GOTO2770
2760 AS="MSC0000/BBS"+DOS:GOSUB860:XILL AS:SN=SN-1
2770 NEXT:IF LEN(NW$)>1 THENSL=CVI(LEFT$(NW$,2)):
SH=CVI(RIGHT$(NW$,2)):GOSUB220 ELSE SL=0:SH=0:GOTO 2820
2780 FOR P=1 TO SN
2790 GET 1,ASC(MID$(PS,P,1))
2800 PUT 1,P
2810 NEXT:CLOSE
2820 GOSUB190:GET 3,1:LSET SL$=MKIS(SL):LSET
SH$=MKIS(SH):LSET SN$=MKIS(SN):LSET SC$=MKIS(SC+1):LSET
ND$=MKIS(ND):LSET NM$=MKIS(NM):LSETDS$=MKIS(DS):PUT 3,1
2830 FIELD 3,255 AS ZM$:LSET ZM$=NW$:PUT 3,3:CLOSE
2840 RUN
```

End

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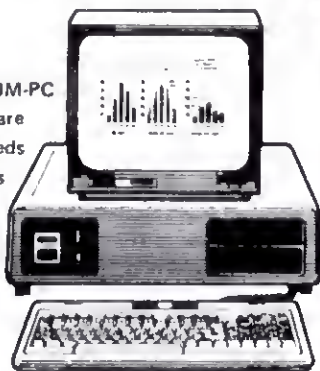
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Arrays Make Data Input An Easy Deal

A Basic array is a list of related data items, either numbers or strings. You store related data under one variable name, and you usually delimit the number of items the array can accept. For instance, the array A(10) holds 10 data items in the array named A. A primary advantage of arrays is that they let you input large amounts of related data quickly.

Numeric vs. String Arrays

Program Listing 1, Numeric Array, demonstrates how to set an array of numeric variables. It starts with a data statement (line 110) that contains the data the program loads into the array variables. Note the form: I've separated each number in the data statement with a comma.

The dimension statement (DIM) in line 120 creates an array with space for five variables. The program dimensions A to 5 to accommodate the five numbers in line 110.

Line 140 reads the data into array variables A(1)-A(5). To see this, run the program, then print A(1), A(2), and so on.

In Program Listing 2, String Array, the data statement in line 110 contains string data (text) rather than numbers. The strings in a data statement don't need quotation marks, as is necessary when you type in Z\$ = "PLUTO".

Line 115 clears 200 bytes for string storage. The Clear statement must come before the dimension statement. Always clear enough bytes to allow for the string space your program needs for arrays, string variables, and literals.

A string array variable must take the form A\$(X) unless you first estab-



Illustration by John Pirman

lish it as a string with the DEFSTR statement.

Rules to Remember

A data statement can be as long as your computer accepts (approximately 255 characters). If you run out of space, you can continue a data list on more data statement lines. Basic reads data sequentially, from left to right, from the lowest to the highest line numbers.

You can put data statements anywhere in a program, but you should put them at the beginning of the program for easy reference.

It's not essential that you dimension arrays containing fewer than 11 items, but I recommend including dimension statements for two reasons: You save memory by defining the limits of arrays and it's good programming practice.

The statement DIM A(10) sets up an 11-item array because arrays start with zero. In Listings 1 and 2, Basic sets numeric array A(0) to a zero value and string array A\$(0) to a null value.

In some programs you might not start with A(0) for reasons of consistency. For example, in the String

Array program in Listing 2, it makes sense to have the array subscript correspond to the month it represents. January is the first month, so you should start with A\$(1).

You can assign an array value with subscripts of zero to 10 without dimensioning an array or giving values to other subscripts in the array. For example, the statement A(10) = 10.5 is legal, even if the program doesn't dimension, read, or assign values to A(0)-A(9).

You can dimension several arrays with one DIM statement by using the form DIM A(50), B\$(Y), Z1(5). To re-dimension an array you must precede it with a Clear statement. Failure to do so results in a Redimensioned Array (DD) error.

A Bad Subscript (BS) error results from using subscripts outside the limits of the array. An Out of Data (OD) error occurs when Basic reads a value into an array without sufficient data. (For more information on error messages, refer to Basic Takes, November 1984, p. 158.)

Some programs read data lines more than once. This requires a Re-

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BASIC TAKES

Program Listing 1. Numeric Array program.

```
100 REM * NUMERIC ARRAY * LISTING NO. 1 *
110 DATA 10,6,9,23,15
120 DIM A(5)
130 FOR X=1 TO 5
140 READ A(X)
150 NEXT X
160 END
```

End

Program Listing 2. String Array program.

```
100 REM * STRING ARRAY * LISTING NO. 2 *
110 DATA JAN,FEB,MAR,APR,MAY
120 DIM A$(5)
130 FOR X=1 TO 5
140 READ A$(X)
150 NEXT X
160 END
```

End

Program Listing 3. Template program.

```
100 REM * TEMPLATE * LISTING NO. 3 *
110 DIM A(5)
120 FOR X=1 TO 5
130 REM * THIS LINE MUST BE REPLACED
135 A(X)=X
140 NEXT
150 END
```

End

Program Listing 4. Dimension by Variable program.

```
100 REM * DIMENSIONING BY VARIABLE * LISTING NO. 4
110 CLS
120 INPUT "HOW MANY ITEMS IN ARRAY LIST";X
130 DIM A(X)
140 FOR C=1 TO X
150 PRINT "VALUE NUMBER"C
160 INPUT Z
170 A(C)=Z
180 NEXT C
190 END
```

End

Program Listing 5. Coin Toss program.

```
100 REM * COIN TOSS * LISTING NO. 5 *
110 DIM P(2)
120 FOR X=1 TO 10
130 T=RND(2)
140 REM * MODEL 100, MAKE ABOVE LINE: 130 T=INT(1+RND(1)*2)
150 P(T)=P(T)+1
160 NEXT X
170 PRINT
180 PRINT "SCORE: HEADS:"P(1)" TAILS:"P(2)
190 END
```

End

Program Listing 6. Card Dealer Program.

```
100 REM * CARD DEALER * LISTING NO. 6 *
110 CLEAR 500
120 DIM A$(52)
130 RANDOM
140 REM * MODEL 100, MAKE ABOVE LINE: 130 V=VAL(RIGHT$(TIMES,2)):
FOR T=1 TO V: G=RND(1): NEXT T
150 B=1
160 S$="CDNS"
170 A$="A23456789TJQX"
```

Listing 6 continued

Card Dealer uses arrays to simulate dealing a deck of cards.

store statement to set the data pointer back to the first item in the data list and prevent an OD error.

At the location in the program where you want the pointer to move to the start of the first data line, type RESTORE.

In a program with data on lines 110 and 120, you can type in RESTORE 120 to set the data pointer to the start of line 120 (Model 4 only).

Programming Techniques

Template, in Program Listing 3, demonstrates another way to establish a numeric array. Type in the listing, then type in 130 A(X)=X. This picks up the incremented value of X and passes it to array variable A(X).

Now substitute INPUT "VALUE"; A(X) for line 130. The program waits for you to input a numeric value and press the enter key.

Here's a change for the Models I and III: 130 A(X)=RND(100). This line provides random input, and is useful in programs that check varied outcomes using the same set of random values.

Dimensioning by Variable, in Program Listing 4, lets you input the dimension of the program array. Line 120 prompts you to set the number of array subscripts. Input 10, and line 130 becomes DIM A(10). The For...Next loop in lines 140-180 lets you set values for A(1)-A(10).

Coin Toss, in Program Listing 5, tests probability against results and shows how array values can change during a program run. P(1) is player 1, who wants heads, and P(2) is player 2, who wants tails.

The For...Next loop in lines 120-160 tosses the coin 10 times. Line 130 generates random output. If it outputs a 1, line 150 increments the P(1) score by 1. If it produces a 2, the program adds 1 to P(2). Line 180 prints the ending scores.

Program Listing 6, Card Dealer, uses arrays to simulate dealing a deck of cards. Line 110 clears 500 bytes. Line 120 reseeds the random number

generator, and in line 150 B = 1 represents the first card in the unshuffled deck.

Line 160 contains the suits: clubs (C), diamonds (D), hearts (H), and spades (S), and line 170 contains the 13 card ranks.

The suit loop (S) starts in line 180 and the rank loop (R) starts in line 190. The four suits and 13 ranks give a total of 52 cards. Line 200 makes the card into the appropriate midstring values of rank (R\$) plus suit (S\$). Line 210 increments B by 1 to set up creation of the next card.

The random dealing routine is in the For...Next loop in lines 230-290. Line 230 starts the loop from 1-52 to ensure that all cards are dealt. Line 260 checks the array string to see if it's already dealt (equal to a dash). If so, the program returns to line 240 for another random number.

Line 270 prints the card chosen, and line 280 changes the array variable to a dash so the program doesn't pick it up again. The program displays the cards in the order they're dealt. Run Card Dealer again and they appear in a different order. This program is a good foundation for creating a card game program.

Multiple-Dimension Arrays

So far I've discussed only single-dimension arrays. Array variable A(4,4,4) is an example of a three-dimensional array representing width, height, and depth. Such an array might be useful in representing Rubik's cube (although it assumes the puzzle has internal cubes).

As a demonstration of multiple arrays, Annual Profit/Loss in Program Listing 7 uses a double-dimensioned array to figure year-end profits or losses.

The months given as data in lines 110-120 become the values of B\$(1)—B\$(12) in line 160. The DIM statement in line 140 establishes a numeric array, A(12,2), 26 variables, and a string array, B\$(12).

Note the mix of string and numeric arrays. In A(12,2), the 12 establishes a row for each month, and the 2 establishes columns for monthly income and expense figures.

The For...Next loop in lines 150-170 reads the months into the B\$(X) array. The loop in lines 180-260 prints the name of the month and leads into

Listing 6 continued

```
180 FOR S=1 TO 4
190 FOR R=1 TO 13
200 A$(B)=MID$(R$,R,1)+MID$(S$,S,1)
210 B=B+1
220 NEXT R,S
230 FOR X=1 TO 52
240 C=RND(52)
250 REM * MODEL 100, CHANGE LINE 240 TO 240 C=INT(1+RND(1)*52)
260 IF A$(C)="-" THEN 240
270 PRINT A$(C); " ";
280 A$(C)="-"
290 NEXT X
300 END
```

End

Program Listing 7. Annual Profit/Loss program.

```
100 REM* ANNUAL PROFIT/LOSS * LISTING NO. 7 *
110 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY
120 DATA AUGUST,SEPTEMBER,OCTOBER,NOVEMBER,DECEMBER
130 CLS
140 DIM A(12,2), B$(12)
150 FOR B=1 TO 12
160 READ B$(B)
170 NEXT
180 FOR B=1 TO 12
190 PRINT B$(B) " REPORT"
200 PRINT
210 FOR C=1 TO 2
220 IF C=1 THEN INPUT "INCOME";M ELSE INPUT "EXPENSES";M
230 A(B,C)=M
240 NEXT C
250 CLS
260 NEXT B
270 CLS
280 PRINT "PRESS A KEY TO SEE NEXT ENTRY."
290 PRINT "ANNUAL RESULT"
300 PRINT "MONTH";TAB(10);"INCOME";TAB(20);"EXPENSES";TAB(30);
"PROFIT"
310 PRINT STRING$(39,"-")
320 FOR B=1 TO 12
330 T=A(B,1)-A(B,2)
340 PRINT B$(B)TAB(10);A(B,1);TAB(20);A(B,2);TAB(30);T
350 V=V+T
360 Z$=INKEY$
370 IF Z$="" THEN 360
380 NEXT B
390 PRINT TAB(25);"TOTAL";V
400 END
```

End

a loop within a loop in lines 210-240. If the C equals 1, the program inputs income; if it equals 2, the program inputs expenses.

January's income variable is A(1,1) and its expense variable is A(1,2). The subscripts continue to A(12,1) for income and A(12,2) for expenses for December.

Line 230 makes the array variable worth the value you input for M. (You can combine lines 220-230 by substituting A(B,C) for M in line 230 and deleting line 230.)

The second part of the program prints the results, month by month, as well as the month's profit/loss total. The program obtains the results by subtracting each month's expenses from profits (line 330).

Line 340 displays the information, line 350 increments V by the month's total, and line 390 displays the yearly total.

You can use triple- or even quadruple-dimensional arrays. Multiple-dimensional arrays use up memory, however. A 4-by 4-by 4-dimension array sets aside space for 64 variables.

Next Month

Next month's topic is streamlining programs. Call it packing, call it crunching, it's all about how to make programs shorter and faster. See you then. ■

You can reach Richard Ramella at 1493 Mt. View Ave., Chico, CA 95926.

Teaching Old Basic New Tricks

One of the most fascinating aspects of computer languages like Lisp, Logo, and Forth is that they aren't completely defined; you can customize them to suit your needs. The longer you use them, the more functions your implementation of the language has. The computer constantly "learns" new commands as you program.

Model I/III Basic, on the other hand, seems set in cement because most of its code, as well as Disk Basic's, is stored in unchangeable ROM. Whenever you type in NEW, RUN, or CLEAR, the computer forgets everything you've done and starts with a clean slate. But Basic really isn't set in cement; you can make changes to it. Several commercial products are available that let you extend TRS-80 Basic with new commands. You can also add your own commands to Basic to make it do whatever you want.

During the next few months, I'll describe ways you can add commands to Basic. This month I'll explain some of the fundamental concepts; in future columns I'll include some specific commands as well as methods for hooking them into the Basic interpreter.

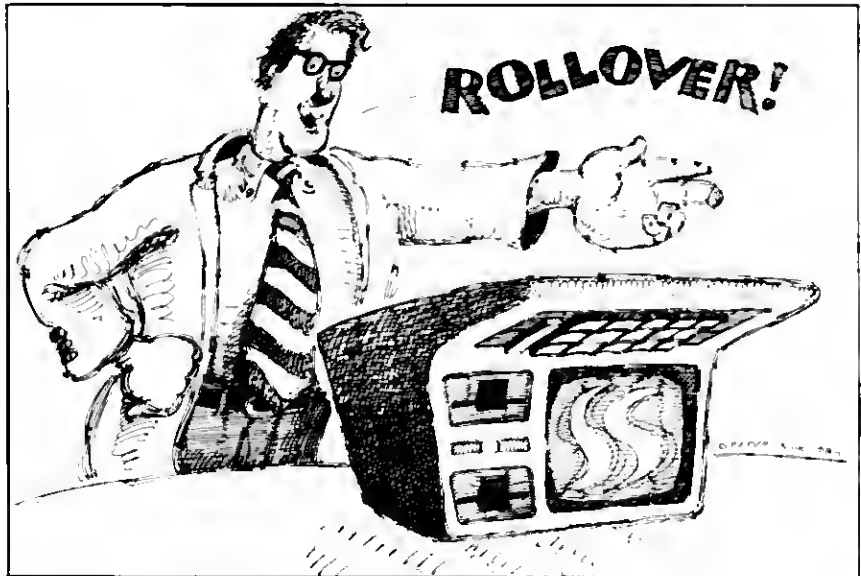


Illustration by Peter Boro

Basic's Structure

As you'd expect from any large program, the TRS-80's ROM Basic is well-organized. When you run a program, the Basic interpreter begins executing each command with the HL register pointing to the last byte that the computer parsed and executed. The interpreter then skips over spaces, tabs, and line feeds to find the next byte in the program, which it places in

the A register and uses to determine its next action.

Every Basic command is free to use the Z80's registers as necessary as long as it leaves the correct values in HL and AF and restores the stack when finished. Also, the computer executes every Basic command as a subroutine, and each command ends with a RET instruction unless it discovers a program error. You can write your own Model I/III Basic commands as long as they have the structure of a subroutine. In fact, you can do this in several ways.

The real challenge isn't writing new commands, it's finding an appropriate way to hook them into the Basic interpreter. There are four general solutions. You can substitute a new command for a Disk Basic verb, tack one on to the end of a Disk Basic verb as a new syntax form, link one through a DOS exit vector, or (my favorite) hook one into Basic's command interpreter.

Making the Changes

The Table lists the 3-byte vector addresses for each Disk Basic command

Key Word	Hex Address	Key Word	Hex Address
CVI	4152	FIELD	417C
FN	4155	GET	417F
CVS	4158	PUT	4182
DEF	415B	CLOSE	4185
CVD	415E	LOAD	4188
EOF	4161	MERGE	418B
LOC	4164	NAME	418E
LOF	4167	KILL	4191
MKIS	416A	&	4194
MKSS	416D	LSET	4197
MKDS	4170	RSET	419A
CMD	4173	INSTR	419D
TIMES	4176	SAVE	41A0
OPEN	4179	LINE	41A3

Table. Addresses of the 3-byte vectors for each Disk Basic keyword.

THE NEXT STEP

and function. When you use Cassette Basic, it loads each vector with a JP instruction to the L3 error routine (the only exception is that the Model III uses TIMES).

When you run Disk Basic, it loads each vector with a JP instruction to a routine that supports its command or function. You can replace any Disk Basic verb with a new routine by changing the vector's jump address; if you do so, of course, the original function no longer works.

Program Listing 1 demonstrates this technique; the program turns the Disk Basic Name command into a beep command, and produces a short tone through the cassette port or through the internal speaker of a Model 4 in Model III mode (see line 160 for the change for the Model III mode).

Along with the other listings this month, Listing 1 is an example rather than a working program. The new routine sits in the middle of unprotected memory and bombs if Basic overwrites it. (I'll discuss loading and protecting techniques in a future column.)

You can load Listing 1 from DOS Ready and then enter Disk Basic, or load it once you enter Disk Basic. Then use the DEF USR command shown in the comments to hook the routine to Basic. Whenever the interpreter comes across the command Name, it will produce a beep and then continue normally. Since the new routine doesn't require any parameters, it doesn't have to worry about updating the HL register; it merely maintains the value that Basic put there.

Three problems accompany replacing a Disk Basic command with a new routine. First, unless you're using Cassette Basic, you have to give up a function to get a new one. Second, the name you choose for the routine generally has no relationship to its new function. And third, only a limited number of Disk Basic commands are available; if you want to establish a full set of new commands, you'll quickly run out of possible hooks.

The Key Box

Model III
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Program Listing 1. Demonstration showing how to replace Disk Basic verbs by changing the vector's JP address.

```

00010 ;Demonstration Routine #1
00020 ;
00030 ;Use of the NAME command in Basic will create
00040 ;a "beep" from the cassette port (or Model 4
00050 ;internal speaker). Disconnects the normal
00060 ;NAME command if your Disk Basic uses it.
00070 ;
00080 ;To initialize:
00090 ; Load from DOS Ready, then enter Basic.
00100 ; Type "DEFUSR = 4BA000: A=USR(0)"
00110 ; Then test by typing NAME.
00120 ;
410E 00130 NAME EQU 410EH ;Addr. of NAME vector
0000 00140 TONE EQU 00B ;Change if needed
0000 00150 LENGTH EQU 00H ;Change if needed
00FF 00160 PORT EQU 0FFH ;Use Port 90H for
; Mod 4 in Model III mode
00170 ;
00180 ; Initialization Section:
A000 00190 ORG 0A000H ;Pick convenient addr.
A000 3EC3 00200 BEGIN LD A,0C3H ;Jump instruction in A
A002 210CA0 00210 LD HL,START ;Get routine address
A005 32BE41 00220 LD (NAME),A ;Put JP in place
A008 220F41 00230 LD (NAME+1),HL ;Put addr. in place
A00B C9 00240 RET ;Return from USR call
00250 ;
00260 ; Beep Routine called by NAME:
A00C 1600 00270 START LD D,TONE ;Tone and length
A00E 1E00 00280 LD E,LENGTH ; into DE
A010 0EFF 00290 LD C,PORT ;Output port in C
A012 3E02 00300 LD A,2 ;Toggle sound off
A014 F3 00310 DI ;Interrupts off for tone
00320 ;
00330 ;
A015 3D 00330 SNDON DEC A ;A = 1
A016 ED79 00340 OUT (C),A ;Send it out
A018 42 00350 LD B,D ;Get count
A019 10FE 00360 DJNZ $ ;And wait 1/2 cycle
00370 ;
A01B 3C 00380 SNOFF INC A ;A = 2
A01C ED79 00390 OUT (C),A ;Send it out
A01E 42 00400 LD B,D ;Get count
A01F 10FE 00410 DJNZ $ ;And wait 1/2 cycle
00420 ;
A021 1D 00430 DEC E ;Drop length count
A022 20F1 00440 JR NZ,SNDON ;Repeat until done
A024 AF 00450 XOR A ;A = 0
A025 ED79 00460 OUT (C),A ;Turn off cassette port
A027 FB 00470 EI ;Interrupts back on
A028 C9 00480 RET ;Return to interpreter
00490 ;
A000 00500 END BEGIN
00000 TOTAL ERRORS
16670 TEXT AREA BYTES LEFT

```

End

Program Listing 2. Demonstration showing how to create the simple beep generator as a Disk Basic verb followed by an exclamation point.

```

00100 ;Demonstration Routine #2
00110 ;
00120 ;Use of CMD! will create a "beep"
00130 ;from the cassette port (or Model 4
00140 ;internal speaker). Does not disturb normal
00150 ;CMD uses.
00160 ;
00170 ;To initialize:
00180 ; Load from DOS Ready, then Enter Basic
00190 ; Type "DEFUSR = 4BA000: A=USR(0)"
00200 ; Test by typing CMD!
00210 ;
4173 00220 CMD EQU 4173H ;Vector addresses
0000 00230 TONE EQU 00H ;Change if needed
0000 00240 LENGTH EQU 00H ;Change if needed
00FF 00250 PORT EQU 0FFH ;Use Port 90H for
; Mod 4 internal spkr
00260 ;
00270 ;
00280 ; Initialization Section:
A000 00290 ORG 0A000H ;Pick convenient addr.
A000 2A7441 00300 BEGIN LD HL,(CMD+1) ;Get orig. addr.
A003 2215A0 00310 LD (ORIG+1),HL ;Stuff address
A006 210DA0 00320 LD HL,START ;Get new addr.
A009 227441 00330 LD (CMD+1),HL ;Sub ours for orig
A00C C9 00340 RET ;Return from USR
00350 ;
00360 ; Beep Routine called by CMD!
A00D F5 00370 START PUSH AF ;Save status flags
A00E 7E 00380 LD A,(HL) ;Get value
A00F FE21 00390 CP '!' ;Time to beep?
A011 2004 00400 JR Z,YES ;Go if yes
00410 ;
A013 F1 00420 POP AF ;Else recover status
A014 C30000 00430 ORG JP $-$ ;Go to orig. routine
00440 ;
A017 110000 00450 YES LD DE,TONE<0+LENGTH ;Tone and len. to DE
A01A 0EFF 00460 LD C,PORT ;Port to C
A01C 3E02 00470 LD A,2 ;Toggle sound off

```

Listing 2 continued

Listing 2 continued

```

A01E F3      00400      DI          ;Don't interrupt beep
A01F 3D      00490      ;
A020 ED79    00500      SNDON      DEC      A          ;A = 1
A022 42      00510      OUT        (C),A        ;Send it out
A023 10FE    00520      LD          B,D          ;Get count
A024 10FE    00530      DJNZ       $            ;Wait 1/2 cycle
A025 3C      00540      ;
A026 ED79    00550      SNOFF      INC      A          ;A = 2
A028 42      00560      OUT        (C),A        ;Send it out
A029 10FE    00570      LD          B,D          ;Get count
A030 10FE    00580      DJNZ       $            ;Wait 1/2 cycle
A031 1D      00590      ;
A032 1D      00600      DEC        E            ;Drop length count
A033 20F1    00610      JR          NZ,SNDON      ;Loop until done
A034 AF      00620      XOR        A            ;A = 0
A035 ED79    00630      OUT        (C),A        ;Turn off port
A036 FB      00640      EI            ;Interrupts back on
A037 1D      00650      ;
A038 1D      00660      POP        DE          ;Restore stack
A039 23      00670      INC        HL          ;HL=>Char after "!"
A040 C9      00680      RET            ;Return to interpreter
A041 00      00690      END          BEGIN
00000 TOTAL ERRORS
16535 TEXT AREA BYTES LEFT

```

End

It doesn't matter which Disk Basic command you choose; the idea is to create a new syntax that would normally be impossible.

Another technique is to add to the syntax of an existing Disk Basic command. It doesn't matter which Disk Basic command you choose, although CMD is the most likely candidate. The idea is to create a new syntax that would normally be impossible.

Program Listing 2 shows how you can create the simple beep generator as "CMD!" (or almost any other Disk Basic verb followed by an exclamation mark). However, this technique only works if you pick a Basic command normally used as the first or the only command in a Basic function. Don't try to use commands like INSTR that can only occur after an equals sign.

Written this way, the new command is essentially a filter. When the program invokes the Disk Basic verb associated with the command, it checks to see if the next character(s) is part of the new syntax. If not, control passes to the regular routine for that Basic verb. If you're invoking the new routine, it performs its operations, sets HL properly, and uses a Return instruction to get back to the normal flow of Basic.

Listings 1 and 2 differ in two important ways. First, the initialization section of Listing 2 doesn't destroy the original address in the CMD vector; instead, the program saves that address (at ORIG + 1 in line 430) so that it can jump to DOS's CMD routine when a command other than "CMD!" is interrupted.

Second, the body of the beep routine starts by saving the AF registers on the stack (line 370). Before the interpreter calls a Basic command, the computer processes the character following the command token (the 1-byte representation of the command verb). Basic points the HL register to that next byte, then sets the status flags to indicate whether the byte is a colon (Z

Program Listing 3. Demonstration showing how to add a beep function to Disk Basic by interrupting the Basic interpreter as it starts to parse a command.

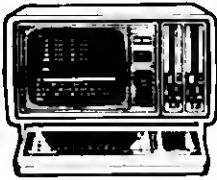
```

00010 ;Demonstration Routine #3
00020 ;
00030 ;Use of a '!' will create a "beep"
00040 ;from the cassette port (or Model 4
00050 ;internal speaker). Operates by intercepting
00060 ;control from Basic's command interpreter.
00070 ;
00080 ;To initialize:
00090 ; Load from DOS Ready, then enter Basic.
00100 ; Type "DEFUSR = <A000>: A=USR(0)"
00110 ; Test by typing !
00120 ;
4003 00130 INTERP EQU 4003H ;Interpreter link
0000 00140 TONE EQU 00H ;Change if needed
0000 00150 LENGTH EQU 00H ;Change if needed
0000 00160 PORT EQU 00FH ;Use Port 00H for
0000 00170 ; Mod 4 internal spkr
0000 00180 ;
0000 00190 ; Initialization Section:
0000 00200 ORG 0A000H ;Pick convenient addr
0000 2A0440 00210 BEGIN LD HL,(INTERP+1) ;Get orig. addr.
0000 2218A0 00220 LD HL,(ORIG+1),HL ;Stuff into program
0000 210DA0 00230 LD HL,START ;Get our address
0000 220440 00240 LD HL,(INTERP+1),HL ;Sub ours for orig.
0000 C9 00250 RET ;Return from USR
0000 00260 ;
0000 00270 ; Beep Routine:
0000 00280 START EX (SP),HL ;Get top of stack
0000 7D 00290 LD A,L ;Get 1st of return addr.
0000 FE5B 00300 CP 5BH ; and test it
0000 2003 00310 JR NZ,NO ;Go if not xx5BH
0000 7C 00320 LD A,H ;Get 2nd of return addr.
0000 FE1D 00330 CP 1DH ; and test it
0000 E3 00340 NO EX (SP),HL ;Restore stack & HL
0000 C20000 00350 ORIG JP NZ,$-$ ;Go if wrong return addr.
0000 00360 ;
0000 00370 CALL 1D70H ;Get next character
0000 FE21 00380 CP '!' ;Beep requested?
0000 2003 00390 JR Z,YES ;Go if it is
0000 2B 00400 DEC HL ;Else fix HL
0000 10F3 00410 JR ORIG ;And leave
0000 00420 ;
0000 00430 ;"!" Was found
0000 110000 00440 YES LD DE,TONE<B+LENGTH ;Tone and len. in DE
0000 00FF 00450 LD C,PORT ;Port address to C
0000 3E02 00460 LD A,2 ;Toggle for off
0000 F3 00470 DI ;Don't interrupt beep
0000 00480 ;
0000 00490 ;
0000 3D 00500 SNOFF DEC A ;A = 1
0000 ED79 00510 OUT (C),A ;Send it out
0000 42 00520 LD B,D ;Get tone count
0000 10FE 00530 DJNZ $ ;Wait 1/2 cycle
0000 00540 ;
0000 3C 00550 SNOFF INC A ;A = 2
0000 ED79 00560 OUT (C),A ;Send it out
0000 42 00570 LD B,D ;Get tone count
0000 10FE 00580 DJNZ $ ;Wait 1/2 cycle
0000 00590 ;
0000 1D 00600 DEC E ;Drop length count
0000 20F1 00610 JR NZ,SNDON ;Loop until done
0000 AF 00620 XOR A ;A = 0
0000 ED79 00630 OUT (C),A ;Turn off port
0000 FB 00640 EI ;Interrupts back on
0000 00650 ;
0000 23 00660 INC HL ;Point to char after !
0000 C9 00670 RET ;Return to interpreter
0000 00680 END BEGIN
00000 TOTAL ERRORS
16253 TEXT AREA BYTES LEFT

```

End

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flag set), numeric (C flag set) or neither (NZ and NC set).

Many routines start by examining the flags as a first check for correct syntax. If the flags were not correctly restored in line 420, the normal CMD processor would likely report a syntax or type mismatch error.

Program Listing 3 shows a third way to add a beep function to Disk Basic. The program works by interrupting the Basic interpreter as it starts to parse a command. If it finds your special command, the program executes it; otherwise control passes to the normal Basic interpreter.

Basic begins parsing and executing each command in ROM at 1D5A hexadecimal (hex) with an RST 10H instruction. From 0010 hex, the program sends control to RAM location 4003 hex. If you're using Cassette Basic, TRSDOS, or NEWDOS80, 4003 hex contains the instruction JP 1D78H, which sends control to a routine that finds the next character in the program, and adjusts HL to point to it (LDOS, DOSPLUS, MULTIDOS, and the Stringy Floppy system use a different jump at 4003 hex to perform some special instructions).

Listing 3 interrupts the normal flow of control at 4003 hex. First, starting in line 370, it tests the return address on the stack to be sure that this RST 10 hex call came from 1D5A hex. If the return address isn't 1D5B hex, the program gets out of the way by jumping to the original address stored at 4003 hex.

Basic changes keyboard symbols to a form completely different from their ASCII codes.

If the address on the top of the stack was correct, Listing 3 calls 1D78 hex to find the next valid character and checks to determine if it's an exclamation point. If not, the program decrements the HL register once to point to the previous byte and again control passes to the original address (lines 460-500).

Finally, if the program finds the correct return address, and if the next input character is an exclamation point, the program produces a beep. It ends by pointing HL to the next position after the exclamation point and then returning to the Basic interpreter. You must end the routine with HL and the stack set correctly, and with the Z flag set (line 700).

If you want to experiment with this final technique, select new command names carefully. Unless your program carefully checks each name, you must make sure that each new command starts with a character that could not normally appear at the beginning of a Basic command. If, for example, you chose a command A, you could never use a variable that started with the letter A without generating a syntax error.

Also, Basic changes keyboard symbols (such as the arithmetic operators) to a tokenized form completely different from their ASCII codes. If you use one of those symbols as your command name, your program will have to check for the tokenized form.

Coming Up

Next month, I'll discuss another technique for adding new commands to Basic, and start to develop a program that lets you add many new Basic commands in a single program.

Remember that if you write to me and want a reply, you must enclose a stamped, self-addressed envelope. I am happy to try to answer your questions about Assembly language or use of your Model I, III, or 4. However, because of the amount of mail I receive, I cannot respond if you don't include a stamped envelope. In any case, I always welcome your comments, questions, and suggestions. ■

Readers who subscribe to CompuServe can ask questions or take part in discussions on topics covered by "The Next Step." Go PCS-117 to the Writers' and Editors' Special Interest Group (WESIG) and leave your questions or comments addressed to Hardin Brothers. Feel free to join in conversations started by others.

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A Rematch Between Two Data Base Systems

I'll devote part of this column to clearing up a problem of transferring graphics-based software between the Model I/III and the Tandy 2000. I'll also revisit an earlier topic: my comparison of Profile III+ to dBase II.

Customized Graphics

Now that you have a tool for converting Model I/III Basic software to run on the Tandy 2000 (see October 1984, p. 178), you may have encountered another problem: Some programs won't convert because they use Model I/III-specific graphics. Paul Opitz's CHAREDIT program in the final issue of the *TRS-80 Microcomputer News* (volume 6, issue 6) solves the problem by letting you customize the Model 2000 character set.

While using Opitz's program to design a complete Russian alphabet, I realized that I could also replicate the Model I/III graphics character set on the Model 2000. The set I created replaces Model 2000 characters 128-191 with the appropriate Model I/III graphics characters. That allowed me to convert many of my Basic programs without any reprogramming. Unfortunately, this method doesn't work with programs that depend on the Set, Reset, and Point commands to display graphics.

The Program Listing (p. 149) supplies Basic subroutines that duplicate the Model I/III's Set, Reset, and Point functions on the 2000. With these subroutines saved to disk in ASCII format, it's a relatively simple (albeit tedious) task to change Model I/III graphics commands to linkages for these subroutines. I recommend editing the ASCII text of the program with a capable word processor.

The GRINIT routine is the heart of the program. It loads the Model I/III graphics character set modified by CHAREDIT and sets up the byte masks for later use. The next three routines are all very similar; they share



Illustration by Phil Geraci

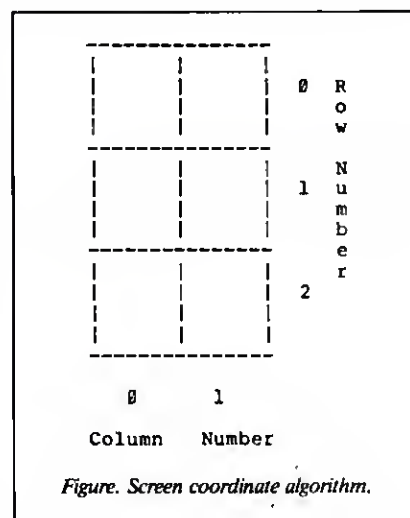
much of the same code. I chose not to put this code in one more subroutine because another function call would have slowed the program down too much. To increase speed, remove all comments and any extraneous blanks, combining as many statements on one line as possible. Table 1 lists the program's variables. The Figure uses a typical character cell divided into graphics pixels to illustrate the variables and their use.

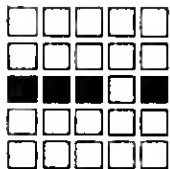
If you'd like the character set editor (CHAREDIT and FONTINIT), the character sets (Russian and Model I/III graphics), and/or the graphics routines in the Listing, send a disk and a self-addressed mailer to me at 1519-A Carswell Circle, Bolling Air Force Base, Washington, DC 20336. Make sure the mailer has correct return postage. For the character set editor, specify the type of display you're using (monochrome/color, graphics/no graphics).

Battle of the Data Bases—Round Two

In my first column (August 1984, p. 177), I illustrated dBase II's versatility

by comparing its major features to those of Profile III+. I must admit that this was unfair; comparing programs that run under different operating environments is never really fair. However, the Small Computer Co. called my attention to a very powerful extension to the Profile III+ system called filePro-16 (see Table 2). FilePro-16 is available for the Model 2000 and is a single-user, feature-for-





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feature adaptation of the multiuser Profile-16 system currently available for the Model 16.

FilePro-16 contains an extensive reference manual, program disks, an installation manual, and a start-up manual with a beginner's and an advanced tutorial. The system is huge. Hard disk Model 2000 users will generally have no problem with the program's size, but floppy users will be dismayed at having to use separate creation and runtime disks, as with Profile III+. Remember, Model 2000 disks hold four times as much as Model III disks, but filePro-16's code still doesn't fit on the two program disks—the special character print codes are on another disk.

FilePro-16 is a superior product. The limitations of Profile III+ have been corrected. For example, you can add data and lengthen or shorten any data base file easily. It automatically updates indexes once you define them. You can also build very powerful menus that let you structure applications for easy use by someone unfamiliar with the filePro-16 commands.

FilePro-16's added features are very capable: the ability to spread files over several disks, flexible and numerous input/output format features, and excellent precision in math calculations. FilePro-16 allows over 16 million records per file, and 4,608 characters per record.

With all of these exceptional features in mind, I'll reconsider my original comparison of data base management systems, this time pitting dBASE II against filePro-16. In each of the areas mentioned above, filePro-16 exceeds dBase II's specifications or provides an easier way to perform an operation. Why, then, is there so much demand for dBase II? First, it's essentially universal, providing identical capabilities to any computer that runs CP/M or MS-DOS. Don't discount this feature; it's a most important consideration when you have access to multiple computers.

Probably more important, dBase II, while providing all the data base management functions most people need, is really more of a programming environment than a DBMS. This product's great success derives from its superb flexibility in developing applications. An entire software sub-industry is based on dBase programming.

Variable Description

ZX	Specifies the horizontal location of the graphics pixel (0-159)
ZY	Specifies the vertical location of the graphics pixel (0-71)
CX	Character location within the selected row containing the pixel (1-80). This is the integer quotient of ZX/2.
CY	Character location within the selected column containing the pixel (0-24). This is the integer quotient of ZY/3.
CL	Selects the graphics column by examining the remainder from the calculation of CX.
RW	Selects the graphics row number by examining the remainder from the calculation of CY.
BT	Specifies the bit number within the byte for the action to be performed. This value ranges from 0 to 5 and is used to select the appropriate mask from either the SM() or RM() arrays.
CH	Contains the value of the character located in the screen memory at the location specified by CX and CY.

Table 1. Variables used in the Program Listing.

Since these two systems cost the same, I must recommend dBase II as the DBMS system of choice because of its greater wealth of support and portability of data and applications. However, if you also use Profile-16 on the Model 16 computer, you may find filePro more appropriate. These two products are virtually identical and provide unparalleled compatibility. Were filePro-16 less expensive, I'd heartily recommend it for use on the Model 2000.

Making dBASE II Better

While I'm on the subject of dBase, I must mention two superior products that I've encountered: DB/RA and dBRx, powerful extensions that overcome some of dBase II's data handling limitations. Although designed specifically for the IBM PC, both run fine on the Tandy 2000.

DB/RA adds the power of one-, two-, or three-dimensional arrays to dBase-II. You can use these arrays with character, logical, or numeric data just as you'd use any other memory variable. In fact, this software extends the number of memory variables available from 64 to over 65,000. A simple statement beginning with the key word Call performs these functions. DB/RA incorporates its own syntax analyzer so these special call statements resemble familiar dBase commands.

dBRx is a math and string extension package making several transcendental functions (sine, cosine, logarithmic, etc.) available for use in data computations. This means you can do most complex calculations within the

dBase II Data Base Manager
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filePro-16 Data Base Management System
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dBRx—The dBase II Math/Stat Program
dBR/RA—The dBase II Array Program
Gryphon Microproducts
P. O. Box 6543
Silver Spring, MD 20906
dBRx; \$150
dBR/RA; \$200

Table 2. Model 2000 product index.

DBMS. The package also supplies three string functions (Pack, BTRIM, and NOSPACE) that enhance the appearance of text data when you display it or print it out. Pack compresses multiple blanks into one, BTRIM trims blanks from the left side of a character string (as opposed to the normal Trim function for removing blanks from the right side), and NOSPACE removes all spaces from the text string. ■

You can reach John B. Harrell III
c/o this column, 80 Micro, 80 Pine
St., Peterborough, NH 03458, or via
CompuServe at 73016,1326.

Program Listing. Graphics conversion routines.

```

8800 *****
8810 GRINIT - set up values for the Model-III graphics routines
8820
8830 No parameters are expected and the values returned are in the
8840 arrays SM() and RM() used by the graphics routines.
8850
8860 GRINIT should only be called once per program execution or an
8870 error will occur when attempting to redimension the arrays.
8880
8890 It may also be necessary to reposition your DATA statements
8900 to prevent conflict with GRINIT.
8910
8920 *****

9000 DIM SM(5),RM(5)
9010 RESTORE 9060 'set up proper location for DATA read
9020 FOR I=0 TO 5
9030 READ SM(I),RM(I) 'read the data masks
9040 NEXT I
9045 BLOAD"mdillect" 'load the graphics character set
9050 RETURN
9060 DATA 1,254
9070 DATA 2,253
9080 DATA 4,251
9090 DATA 8,247
9100 DATA 16,239
9110 DATA 32,223

9900 *****
9910 SET a graphics pixel using Model-III graphics
9920 call by setting ZX and ZY to the location of the pixel
9930 and execute using a GOSUB
9940 ZX must be in the range of 0 to 159
9950 ZY must be in the range of 0 to 71
9960
9970 This subroutine requires initialization by calling GRINIT
9980
9990 *****

10000 CX = INT(ZX/2) + 1: CL = ZX AND 1 ' calculate col (cx) and gr col
10010 CY = INT(ZY/3) + 1: RM = ZY - 3 * (CY-1) ' calculate row and gr row
10020 BT = RM + RM + CL ' bit position within the gr
byte
10030 CH = SCREEN(CY,CX) ' get char at current screen pos
10040 IF CH < 128 OR CH > 191 THEN CH = 128 ' if not graphics -- make blank
10050 CH = CH OR SM(BT) ' set proper bit to turn on
pixel
10060 LOCATE CY,CX: PRINT CHR$(CH); ' locate and replace screen char
10070 RETURN

19900 *****
19910 RESET a graphics pixel using Model-III graphics
19920 call by setting ZX and ZY to the location of the pixel
19930 and execute using a GOSUB
19940 ZX must be in the range of 0 to 159
19950 ZY must be in the range of 0 to 71
19960
19970 This subroutine requires initialization by calling GRINIT
19980
19990 *****

20000 CX = INT(ZX/2) + 1: CL = ZX AND 1 ' calculate col (cx) and gr col
20010 CY = INT(ZY/3) + 1: RM = ZY - 3 * (CY-1) ' calculate row and gr row
20020 BT = RM + RM + CL ' bit position within the gr
byte
20030 CH = SCREEN(CY,CX) ' get char at current screen pos
20040 IF CH < 128 OR CH > 191 THEN CH = 128 ' if not graphics -- make blank
20050 CH = CH AND RM(BT) ' set proper bit to turn on
pixel
20060 LOCATE CY,CX: PRINT CHR$(CH); ' locate and replace screen char
20070 RETURN

29900 *****
29910 TEST a graphics pixel using Model-III graphics
29920 call by setting ZX and ZY to the location of the pixel
29930 and execute using a GOSUB
29940 ZX must be in the range of 0 to 159
29950 ZY must be in the range of 0 to 71
29960
29970 This subroutine requires initialization by calling GRINIT
29980 The function return value is returned in variable ZX:
29981 ZX = -1 (TRUE) -- the pixel is currently set
29982 ZX = 0 (FALSE) -- the pixel is currently reset
29983
29990 *****

30000 CX = INT(ZX/2) + 1: CL = ZX AND 1 ' calculate col (cx) and gr col
30010 CY = INT(ZY/3) + 1: RM = ZY - 3 * (CY-1) ' calculate row and gr row
30020 BT = RM + RM + CL ' bit position within the gr
byte
30030 CH = SCREEN(CY,CX) ' get char at current screen pos
30040 IF CH < 128 OR CH > 191 THEN CH = 128 ' if not graphics -- make blank
30050 CH = CH AND SM(BT) ' set proper bit to turn on
pixel
30060 ZZ = (CH <> 0) ' check if bit is set and return
30070 RETURN

```

End

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Continued from p. 39

menu is Make Basic Lines, which takes everything already entered (saved in a collection of disk files) and pulls it all together into a single, functioning Basic program. You must answer a few prompts, but the process is nearly automatic. The resulting program contains enough comments so that most people familiar with Basic can modify any of it they choose.

But you aren't finished yet. The Producer has created a program whereby you can input data, store it on disk, and edit it at will. But the report structures need to be defined to make that data useful. Once again there is a menu option, Build Reports, that does most of the work.

While the report generator is flexible, it isn't as impressive as the rest of the package. You select which fields of each record to print and in what order. Also, for each report, you can predefine a range of records used to generate the report, or define prompts so the user can make the selections. You can also define a report to create mailing labels.

The Producer lets you define up to nine different report forms for each data-handling program. The different reports will appear on a menu available to the user of the final program.

The Freeform Report Generator

The format of the reports generated is limited unless you use the Freeform Report Generator (available with the enhanced Producer package). This program is the best part of the entire package. It lets you use a variety of report formats, complete with extra calculations, subtotal fields, and grand totals. You can even combine information developed with two or more Producer-generated programs if you have some Basic programming skill.

While the Freeform Report Generator is the most complex part of The Producer, it's difficult to imagine any data base report it couldn't generate. But, the Basic programs it does create are the only part of the package that operate more slowly than I would like.

When you're finished developing both the data-entry programs and the final report forms (which you can add to or modify at any time), you're ready to put all of it together in a Basic program. The last selection from the

main menu is Build Program. After answering a few simple questions, The Producer does all the work for you. You can run the final product either under the tiny DOS supplied or transfer it to a DOS of your choice. You could also compile the program with Microsoft's Bascom, though I haven't tried it.

No matter how complex your program development, the finished product is easy to use. It opens with a combination logo/menu page (you can create your own logo if you want) from which you can enter new data for the data base, edit data previously entered, reorganize the structure of a data base for faster access, perform global search and replace operations on your data, go to a report menu, or exit from the program. All of the standard operations are easy to perform.

Weaknesses

The Producer does have a few weaknesses. First, when defining the record form for the data base, you're limited to information you can fit on a single screen. You can define a total of 32 fields, and the total possible length of each record is limited to 251 bytes. The Producer uses variable-length random-access records to store information, and needs 5 bytes of each record for its binary-tree organization. If you want to use The Producer on NEWDOS80, which allows records longer than 256 bytes, you can alter a Producer program to increase record size, but I haven't yet needed to try.

The system uses a special form of Trashman to speed up string handling and avoid long garbage collection pauses. In general, everything (except reports created with the Freeform Generator) runs fast enough so that all the disadvantages of Basic seem to have been avoided.

The Producer expects that you will want to enter all the string data in uppercase. You can use mixed case easily while creating a program, but only with some unnecessary difficulty in the final program. Such a restriction would make sense on a Model I, but not on a Model III.

The Producer's documentation says that a technical manual was to be available by early 1984, but when I called about it, I was told that no one had even started to write it yet. A quarterly newsletter, as well as techni-

cal help by phone, is available to registered owners.

Overall, The Producer is an excellent package. I've used it to create three separate and very different types of data bases and found it capable of doing everything I wanted it to. If you are looking for a flexible data base manager, seriously consider The Producer. ■

CompuServe on \$5 a Day

by Gary A. Shade

How to Get the Most Out of CompuServe is one of the best books I've read. It not only covers the major areas of this mammoth consumer information service in an easy-to-read manner, but it can save you money. It was a pleasure to read, which is something I can't say about most computer-related books.

Information services like CompuServe are the fastest-growing segments of the telecommunications industry. All services of this type charge for the amount of time you go on-line. Many people (myself included) have found this to be costly, especially when you're first learning to use the system. Charles Bowen and David Peyton recognized the shortcomings of CompuServe's documentation. This book will eliminate your fear and apprehension, and ultimately save you money in connect charges.

The 277-page book is arranged in lessons, each dealing with a different

How to Get the Most Out of CompuServe



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aspect of the system. You start with the basics: logging on, changing your password, and configuring your system. Each excursion you make on CompuServe builds on what you learned in the previous lesson, giving you the knowledge and confidence to explore further.

The authors state that using the lessons will amount to approximately \$36 worth of on-line time, according to current CompuServe rates. But they demonstrate so many shortcuts and advanced features that the charges seem trivial. Even if you plan on only being an occasional user, the \$36 is still a wise investment.

Bowen and Peyton discuss and access every phase of CompuServe within the lessons, from retrieving the weather forecast for your area to using the bland but popular CB simulator. The lessons include the commands necessary to efficiently use each service. Many of the tips have already cut my on-line time and costs.

Full Coverage

Both authors have been sysops (system operators) for various CompuServe special-interest groups (SIGs), so they know their way around the system. They even take you on a tour of The Good Earth SIG (HOM-145), of which Dave Peyton is the sysop.

A trip to the new Compu-U-Store is one of the topics discussed in Chapter 14. A consumer can search the store for an item (over 50,000 are stocked) and order it through this service, which offers goods at a discount. While there is a membership fee for using the Compu-U-Store, the authors walk you through by using the free demonstration.

Other topics and lessons include banking by computer, the electronic mall, financial services, and how to buy software through CompuServe. The reader is shown how to prepare an electronic message through e-mail (electronic mail) and how to post it. Similarly, the authors show how to leave a message on the national bulletin board, which all CompuServe subscribers can access and read.

Advanced lessons demonstrate how to turn off the CompuServe menus (saving you time and money) and how to create your own custom menu. An "On-Line Survival Kit" is included in the Appendix that sum-

marizes the commands used in the different areas. It is arranged in a logical, easy-to-reference manner.

Conclusion

I've been a CompuServe subscriber for nearly three years and I feel comfortable with the services I normally use. Yet I still felt intimidated by the costs of learning new aspects of the network.

During one of my first experiences with CompuServe, I found myself watching screen after screen of text roll by without knowing how to stop it. I frantically searched the manual trying to find the code to terminate it. In frustration, I turned the power off to the modem, disconnecting myself. After calming down, I realized I had just thrown away a half hour of the free time given to new subscribers. I'm sure many other people have had the same type of experience.

The alternative to purchasing *How to Get the Most Out of CompuServe* would be to order the many different user manuals from CompuServe, which explain the areas within the network. But these do little to eliminate the intimidation, confusion, and frustration felt by new users.

This book will save you time and money, from log-on to sign-off. It is for anyone interested in using CompuServe more efficiently, whether a first-time user or experienced veteran. ■

Great Zeus: A Solid Model I/III/4 Editor/Assembler

by Ronald A. Cangro

When I first got Cosmopolitan Electronics' Zeus Editor/Assembler, I was a little disappointed to find that it had a line-oriented rather than a screen-oriented editor. But my apprehension dissipated when I used the system and found it to be fast, versatile, and full of features not found in other editor/assemblers.

Zeus combines the best characteristics of both a line and a screen editor. You can edit anywhere on the screen by moving the nondestructive cursor, but program changes affect the current line only, speeding correction time. And the assembler supports some impressive features: multiple ex-

pressions on a single line, a three-pass assembly operation that significantly speeds up assembly time, comment blocks at the beginning of the object code, and labels. While Zeus lacked a few things, like a macro capability, a built-in debugger, a direct assembly to memory, tape input/output, and a cross-reference facility, it's a good package for developing small- to medium-sized programs.

The Editor

The disk has its own operating system, MULTIDOS (also manufactured by Cosmopolitan Electronics), that runs on a Model I, III, or 4. When you boot up Zeus, the familiar DOS logo appears. Loading Zeus from disk automatically puts you in the edit mode.

The Zeus editor has two modes of operation: line-oriented and character-oriented. On boot-up, you're in the line-oriented mode and you invoke all commands with a single keystroke. Most of the letters correspond to the functions they perform: L loads a source file, D deletes a line, and I lets you insert code (see Table I for a complete list of commands).

Once you load text in the buffer, you can scroll through it; you display a full page of text (16 lines) by pressing the enter key.

Edit commands let you find specific

Zeus Editor/Assembler



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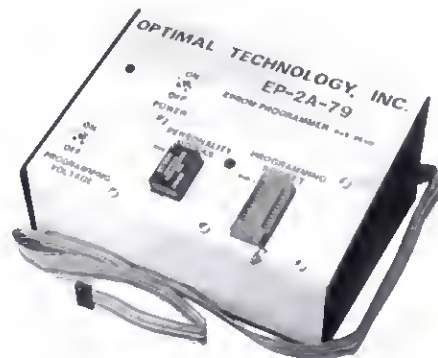


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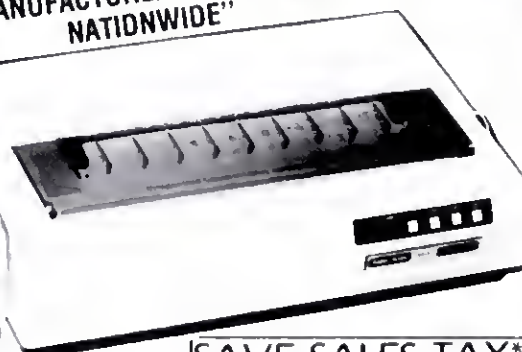
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text character sequences, exact line numbers, and even lines referenced by a specific label. And you can insert text at any time with dynamic line renumbering, allowing unlimited text insertion between any two lines.

You can edit any character within a specific line by using the Edit command, which puts you in the character-oriented edit mode. This is similar to the Basic interpreter editor, with one exception: you see exactly what you're editing at all times. The nondestructive cursor moves left and right over the line, and you use simple control sequences to delete, insert, or overwrite a character, or to move to the end of a line. Use either the down-arrow or clear keys as the control key.

The editor allows a global search and replace of a particular string. For example, you could change all occurrences of STRING1 to STRG1 in one operation. Single-quoted text and comments remain unaffected unless you specify that option. This is a flexible and useful command although it doesn't work on opcodes and operands. You can also move or duplicate a line (or group of lines) anywhere in the text buffer.

It's possible to display the amount of memory the source text, symbol table, and Get file buffers use, as well as how much memory you have left. This is helpful in gauging where to split your source text.

Although you probably won't realize it until it's too late, Zeus's most useful editing command is X. You use it to recover source text when restarting Zeus. You only have to crash your computer once to appreciate it.

The editor also checks every source line for correct syntax as you enter it. It even checks the source code that you load from an ASCII file or an ED-TASM format file before putting it in memory. This saves a lot of time tracking down elusive syntax errors during assembly.

Since Zeus allows editing and assembling without destroying the source code in memory, you may think this means there isn't much room left for serious programming. But the program allows 34K for source and symbol code, and supports the Get pseudo-op that makes it possible to break your source code into modules and store them on disk. The assembler then reads the disk files in sequence. You could actually use the 34K for symbol table storage only.

One handy feature that Zeus lacks is a keyboard macro capability, which would have made it easier to enter commonly used phrases and words with a single keystroke.

The Assembler

The assembler has a rich assortment of features. Table 2 lists the available pseudo-ops. It supports the common

Intel and Zilog pseudo-ops, including multiple expressions on the same line with the DB, DW, and equivalent pseudo-ops. This feature alone makes it worth the price.

It handles conditional assemblies using the If...End...If clause and an ERR error switch. Zeus also provides an assortment of subcommands to control assembly listing and printout, error-handling, object-code generation, and symbol tables. Table 3 shows the assembler subcommands available.

While the assembly is in progress, you can pause and restart the listing. It uses 16-bit operations while evaluating expressions. It does multiplication, division, addition, subtraction, and modulo arithmetic as well as the logical Or, And, left and right shift, and exclusive Or in label evaluation.

One of Zeus's unique features is its three-pass operation. During the first pass, the assembler creates the symbol table and defines the values of the DS, End, EQU, and ORG pseudo-ops. After this phase, you can reference all the lines by label names. During the second pass, the assembler does the actual assembly and directs output to the screen and object file. It then sets a flag. All the additional assemblies with this flag set will proceed with pass three; an instant assembly on all processed source code in the buffer. This definitely speeds up development time.

Command	Description
A	Assemble source code
B	Command mode calculator
C	Global change
D	Delete line(s) from the text buffer
E	Edit specific text line
F	Print line with the specified label
G	Printer format command
H	LPRINT line(s)
I	Insert line(s)
J	LPRINT raw data
K	Kill file
L	Load file
M	Move/duplicate text line(s)
N	Reset (new) text buffer
O	Opcode/operand Reference
P	Print line(s)
Q	Quit/exit
R	Reference
S	Save file
T	Print sorted label table
U	Memory used
X	Recover source text on reentry

Table 1. Zeus editor/assembler commands.

Pseudo-op	Description
COMM	Comment
DEFB or DB	Define byte
DEFL or DL	Define label
DEFM or DM	Define message
DEFS or DS	Define space
DEFW or DW	Define word
End	Terminate assembly
ENDIF	Delimit conditional assembly
ERR	Abort assembly
EQU	Equate
Get	Include source from disk file
If	Begin conditional assembly
List	Control printing
ORG	Origin
Page	Eject to top-of-form
SBTL	Subtitle
TITL	Title

Table 2. Assembler pseudo-ops.

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The duplicator program verifies sectors and tracks up to track 35, where it stops and prompts you to press the enter key, responding with the "Data record not found during read" message. Ignore this and type in backup again. Now repeat the procedure described above. This time, however, don't reformat the disk. By not reformatting, you're able to copy the rest of the disk by skipping the verification process.

Now follow the prompts, and when finished, press the enter key, making sure that you have a MULTIDOS system disk in drive zero. To check your free memory, call up a directory of the original disk. You should have a disk with 96 tracks and 349.5K of free memory.

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DMP-200,120,430 (1290) (1483)	1/2x20	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$27/2 \$81/6 \$162/12	
DMP-500 (1482)	1/2x20	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$24/2 \$72/6 \$144/12	
DMP-2100 - TOSHIBA P1340,1350,51 (1442)	1/2x20	\$15/3 \$54/12 \$288/72	\$7/1 \$8 ea 2 or more	\$15/2 \$42/6 \$ 78/12	
DMP-100, LP VII Commodore 1525, Oerlikon Banana (1424)	Mini-Load	*****	*****	\$18/3 \$48/6 \$ 96/12	
LP III-V (1414)	1/2x15	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$15/2 \$42/6 \$ 78/12	\$12/3 \$44/12 \$252/72
DMP-400/420, LP VI-VIII (1416)	3/16x16	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$15/2 \$42/6 \$ 78/12	\$11/3 \$40/12 \$228/72
EPSON-LO 1500	1/2x14	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$22/2 \$63/6 \$120/12	*****
-MX/FX/RX 70/80 - 18M PC	1/2x20	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$14/2 \$38/6 \$ 88/12	\$12/3 \$44/12 \$252/72
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				SEND CHECK, MONEY ORDER, OR C.O.D. TO	

Another unique feature is the COMM pseudo-op. This generates a comment block at the beginning of the object file. It lets you identify your object code by listing the first portion or by using a disk-zap utility.

Additional Assembler Features

Other features abound. The program has a built-in calculator that lets you convert from decimal to hexadecimal and back again. You can access this from the edit mode.

Many assemblers' weak point is in printing out the source listing. Zeus includes a configuration program; in addition to modifying object code to work with different disk operating systems, the ZCON program sets up printer defaults. You can specify the number of printed lines per page, number of characters per line, total number of lines per page, and whether to use a form-feed or line-feed top-of-form. You can output raw data to the printer at any time with the J command. This lets you send special printer codes even when you're in the middle of an edit session.

Labels have also been a sore spot in other assembler packages. Zeus allows every character and character case to be significant. This amount of flexibility makes the code almost self-documenting.

The disk operating system deserves some mention. You receive a minicopy of MULTIDOS called *ZEUS* supplied on a single-density disk. It has the capability of operating in double-density mode with automatic hardware recognition and automatic density recognition. Table 3 shows the library commands that are available in *ZEUS*.

Documentation

If there's one area where Zeus could use some improvement, it's in the documentation. The problem is more of quantity than quality. What is documented is done fairly well. There's a section detailing each command operation, a fairly large part on the pseudo-ops, and a brief section explaining the creation of system disks and back-copies.

The problem is the lack of a tutorial to show you how to load the editor, enter a simple program, then assemble and list it. As it is, a user is on his own and has to sort through the command

Command	Description
Append	Add one file to the end of another
Auto	Automatic, invincible execution of a command or executable file on power-up
Boot	Reboot the system
Clear	Clear memory from 5200 to TOPMEM
Clock	Enable/disable screen clock
CONFIG	Set default drive attributes on power-up (stepping speed, density, and number of sides)
Date	Set date
DIR	Print disk directory (5 options)
Dump	Transfer memory to disk file
Forms	Set printout parameters
Free	List available disk file space
Kill	Remove a file from the disk
LIB	Print a list of the library commands
List	List a file on the video screen
Load	Load an object file from the disk to RAM
Patch	Modify a disk sector
Print	List a file to the printer
Rename	Change a file name
RESTOR	Recover a killed file
SETCOM	Set RS-232 parameters (Model III only)
SETDIR	Alter directory address marks (Model I only)
Skip	Read a 40-track disk in an 80-track drive
Time	Set time
TOPMEM	Set upper memory limit
Verify	Reread disk sectors for errors
S	Duplicate a single file (similar to Copy)

Table 3. *ZEUS* library commands.

examples to understand all of Zeus's features. I'm still not sure how to exit the program back to DOS without resetting the computer.

An index would also have been a useful addition, especially if the documentation were expanded. Also missing is a description of all the Z80 op-codes. The assumption is that the user is familiar with Assembly language and requires a fast, inexpensive, easy-to-use assembler.

Conclusion

Zeus is a system that should be used by people who require a powerful package to develop smaller programs. But for people who do a lot of sophisticated programming, it's limited without a macro capability, a built-in debugger, a direct assembly to memory, tape input/output, or a cross-reference facility.

On the positive side, it doesn't require disk overlays. The editor is very capable and as easy to use as a full-screen editor. Best of all, it isn't necessary to transfer it to another operating system because *ZEUS* is powerful enough all by itself.

Zeus is a logical progression from the popular EDTASM program. If EDTASM satisfies your programming needs, you may want to check out Zeus. ■

This is TRSDOS 6.2

by Hardin Brothers

Logical Systems Inc. has made microcomputer history by publishing the (almost) complete source code for TRSDOS 6.2 in three volumes. To my knowledge, this is the first time that the source code for a new and living operating system has been published for distribution. Of course, these books aren't inexpensive; at \$99 apiece, they may have established a record as the most expensive paperback books ever published.

Inside the Books

For your \$99, you get an 8½- by 11-inch book filled with commented TRSDOS source code. Volume 1, *The System*, contains the source code for Boot/SYS (or Lowcore), SYS0/SYS (also called Sysres, since it always re-

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mains resident in memory), SYS1 through SYS5 and SYS9 through SYS13.

Volume 2, *The Libraries*, contains the source code for the library modules SYS6 through SYS8. The final volume of the series, *The Utilities*, includes the source code for almost all the TRSDOS 6.2 utility programs.

The three books contain almost 1,100 pages of code, enough to keep even the most dedicated hacker reading and studying for weeks (if not months). LSI prefaces each program with a short description of the functions it performs. The comments throughout the books are sufficient to give an experienced Assembly-language programmer all the information necessary to understand the programs' inner workings (see the sidebar for examples from *The Source*).

Who Needs These Books ?

Why would anyone want such a set of books? Radio Shack has exorcised most of the Model 4 TRSDOS bugs. And it's unlikely that anyone will use them to type in all 1,100 pages of code, since TRSDOS is distributed free with the Model 4/4P.

I think there are four important and likely uses for these books. First, some

people (including me) just like to know how things work. How does TRSDOS handle the video screen? How does it parse commands? What happens when you install Memdisk? If you want to know as much as possible about your Model 4, these books (along with Radio Shack's *Model 4*

Technical Reference Manual) will provide all the answers a software nut could want.

Also, you may want to make modifications to your personal copies of TRSDOS 6.2. Perhaps you'd like to reinstate the Kill command, in addition to Remove, from DOS Ready.

Notes from *The Source*

by Hardin Brothers

Below are some examples of technical information culled from *The Source*. Be sure to make any DOS changes to a back-up copy of TRSDOS 6.2—not an earlier version—and to test the new code thoroughly before moving it to your working copies of the system disk.

● Generally, when you reboot your computer, programs in memory are left untouched. However, TRSDOS 6.2 uses memory locations 4300-43FF hexadecimal for the boot routine, so any program in that area will be destroyed.

● If you want to change the definition of the function keys temporarily while in Basic, the lookup table with their values is stored from 0918-091D hexadecimal. The values are stored in this order: F1, shift F1, F2, shift F2, F3, shift F3. You can POKE new values into those bytes, but the computer will react improperly if you try to define them as break, clear, or pause. Be sure to reset the values (or reboot the computer) before using any program that expects the F keys to have their original values.

● You need change only a single byte in SYS1/SYS to activate the Kill command in addition to Remove. LIB will also add Kill to the list of commands it displays if you add this patch:

PATCH SYS1/SYS.LSIDOS (X'2054' = "K")

● The @DATE SVC puts a formatted version of the system date into a buffer as MM/DD/YY. But it also returns with DE pointing to DOS's date storage area (DATES\$ + 0) at 0033H. The storage scheme is:

DATES + 0 Year (80-87)
DATES\$ + 1 Day of month (1-31)
DATES\$ + 2 Month (1-12)
DATES\$ + 3 Bits 0-7 of day of year

DATES + 4 Bit 0 = bit 8 of day of year
Bits 1-3 contain day of week
Bit 7 set if leap year.

You could find the day of the week in Basic with this code:

```
D% = ((PEEK(&H0037) OR 14)/2) - 1
D$ = "SunMonTueWedThuFriSat"
DAY$ = MID$(D$, D% * 3 + 1, 3)
```

● A 2-byte patch space in the Click/FLT makes the audible click operate on a specific key or set of keys. The current code is:

```
2474 0000 I060 DW 00
2476 201C I070 JR NZ,LEAVE
```

Also, at 247A hexadecimal, the computer loads the D register with the click tone value and the E register with the click duration value. One interesting change to the Click/FLT is the following:

.Patch to CLICK/FLT.FILTER to make a beep only when <ENTER> is pressed.

.First, test for <ENTER>

X'2474' = FE 0D

.Set the duration

X'247B' = 80

.Set the tone

X'247C' = FF

.End of patch.

● I dislike the Device command default parameters. I'd much rather have the D parameter default to off and the B parameter default to on. This patch will accomplish that:

.Patch to change DEVICE defaults
.Apply to SYS6/SYS.LSIDOS

.Position to DEVICE Library command
L61

.Set D parameter to default D = N
X'241E' = 00 00

.Set B parameter to default B = YES
X'2580' = FF FF

.End of patch

The Source:TRSDOS/ LS-DOS 6.2



Logical Systems Inc.
8907 North 55th St.
P.O. Box 23956
Milwaukee, WI 53223
800-248-3535

Volume 1-The System \$99
Volume 2-The Libraries \$99
Volume 3-The Utilities \$99
\$249 for all three

Well written? ★ ★ ★ ★ ☆
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The necessary bytes are sitting in SYS1/SYS's command interpreter just waiting for you to change a NOP byte (00H) to a 'K'. Perhaps you want to add your own supervisory calls (SVCs) or to determine the side effects of some of the present calls.

You could also use the books to create your own utility programs that take full advantage of what's already available with TRSDOS 6.2. I've experimented recently with a split-screen terminal program for CompuServe's CB simulator and special-interest group conference areas. I have the program working as a dumb terminal, but I'd like to add a capture buffer and other enhancements found in the TRSDOS's COMM program. After studying COMM's source code, I've found ways to add the appropriate patches. I won't have to spend hours duplicating work that has already been done.

Probably the most important purpose of the source code is to give software developers all the help they need in producing packages for the Model 4. The inner workings of the Model I/III ROMs have been published for several years, and have helped software writers considerably. A similar knowledge of the Model 4's operating system may (hopefully) lead to more interesting and complex programs for the Model 4.

What's Missing

While these books are nearly complete, they do lack a few things. Whenever the code accesses the Model 4's hardware directly through a port, the source lines have been omitted but the object code is still present. I assume these omissions are made to respect Tandy's proprietary secrets and also to mark those sections of code that are specifically Model 4-oriented (the same code is essentially used for Model II, 12, and 16 computers, and LSI hopes that other manufacturers of Z80 computers will begin using TRSDOS 6.2 as well).

Also, the source code for the Help utility is missing from Volume 3. This last omission is unfortunate, because the Help command can be expanded to cover topics in addition to DOS commands. As of this writing, neither LSI nor Tandy has explained how to do so (I will, however, discuss how to add new Help files in a future install-

ment of The Next Step).

Missing from these books, of course, is the Basic source code (owned by Microsoft) as well as MODELA/III, probably for similar reasons. But I didn't expect to see either of those.

These books are an important addition to my library. It's one thing to be able to use TRSDOS 6.2 well: knowing the source code gives you more in-

sight into how programs interact with the system. Whether you should buy one or all of these books depends on your level of sophistication and the complexity of the programs you need to write. The wealth of information in these books isn't difficult to find or understand, but their cost may deter many hackers and hobbyists from buying them. ■



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PROJECT 80

Listing continued from p. 130

```

7867 E5      01070      PUSH    BL      ; THE STACK
7868 D5      01080      PUBB    DE
7869 3E10     01090      LD      A,10H      ;WRITE BYTE TO ENABLE
786A D3EC     01100      OUT     (TRSEX),A    ; EXTERNAL I/O ACCESS
786B DBE0     01110      IN      A,(TRSDI)    ;CHECK IF EXT. I/O INT.
786C CB5F     01120      BIT     3,A        ;I/O BUS INT.?
786D 281A     01130      JR      NZ,NOTHER  ;IF NOT LOW, NOT HERE
786E 380C     01140      LD      A,0CH      ;GET OCW2 WORD FOR 8259A
786F D328     01150      OUT     (PIC0),A    ;CHECK FOR 8259A INT.
7870 DB28     01160      IN      A,(PIC0)    ;GET 8259A RESPONSE BYTE
7871 CB7F     01170      BIT     7,A        ;INTERRUPT GENERATED?
7872 2810     01180      JR      Z,NOTHER  ;IF ZERO, NOT BY 8259A
7873 CB27     01190      SLA      A        ;ELSE, DOUBLE VALUE TO
7874 E60F     01200      AND      0FH      ; GET TABLE OFFSET
7875 210870    01210      LD      HL,INTBL  ;CLEAR UPPER BITS
7876 5F        01220      LD      E,A      ;POINT TO TABLE BEG.
7877 1600      01230      LD      D,0      ;PUT OFFSET INTO E REG.
7878 19        01240      ADD     HL,DE    ;CLEAR UPPER OFFSET BYTE
7879 5E        01250      LD      E,(HL)   ;POINT TO INT. VECTOR
787A 23        01260      INC     HL      ;GET LOW ADDR. BYTE
787B 56        01270      LD      D,(HL)   ;INCREMENT TABLE PTR.
787C EB        01280      EX      DE,HL   ;GET HI ADDR. BYTE
787D CB27     01290      JP      (BL)    ;PUT ADDR. INTO HL
787E 21BC70    01300      LD      HL,RESTOR ;GET RETURN ADDRESS OF ISR
787F E5        01310      LD      HL      ; AND PUT IT ON THE STACK
7880 2A1270    01320      LD      HL,(VECTOR) ;GET ISR ADDRESS
7881 E9        01330      JP      (HL)    ;CALL THE SUBROUTINE
7882 1825      01340      JR      RESTOR   ;RESTORE STUFF AND RETURN
7883 3A1170    01350      LD      A,(TINCNT) ;GET INT. COUNTER
7884 3C        01360      INC     A      ;INC. IT FOR THIS ISR
7885 321170    01370      LD      A,(TINCNT),A ;SAVE IT AGN IN MEM.
7886 FE04      01380      CP      4      ;HAVE FOUR INTS. OCCRD?
7887 280E      01390      JR      NZ,DONE   ;IF NOT, FINISH UP
7888 AF        01400      XOR     A      ;ELSE, CLEAR COUNT
7889 321170    01410      LD      A,(TINCNT),A ; IN MEMORY.
788A 3A1870    01420      LD      A,(PPIBT),A ;GET 8255A PORT B BYTE
788B C610      01430      ADD     A,10H    ;INCREMENT LED DISPLAY
788C 321070    01440      LD      A,(PPIBT),A ;SAVE BACK IN MEM.
788D 3221      01450      OUT     A,(PPIB),A ;WRITE TO 8255A PORT B
788E D321      01460      LD      A,24H    ;GET LOW TIMER COUNT BYTE
788F 3E24      01470      OUT     A,(PIT0),A ;WRITE TO TIMER 0
7890 D324      01480      LD      A,0F4H   ;GET HIGH COUNT BYTE
7891 3E24      01490      OUT     A,(PIT0),A ;WRITE TO TIMER 0
7892 D324      01500      LD      A,20H    ;GET EO1 (OCW2) CMD
7893 3E28      01510      OUT     A,(PIC0),A ;SEND TO 8259A
7894 3208      01520      LD      A,00H    ;WRITE BYTE TO ENABLE
7895 D308      01530      OUT     A,(TRSDI),A ; EXTERNAL I/O INTS.
7896 D1        01540      POP     DE      ;RESTORE REGISTERS
7897 E1        01550      POP     HL      ; FROM STACK
7898 F1        01560      POP     AF
7899 FB        01570      EI          ;RE-ENABLE INTERRUPTS
789A C9        01580      RET      ;DONE - RETURN FROM INT.
789B 1610      01590      LD      A,16H    ; INTRPT
789C 1620      01600      LD      A,16H    ; INTRPT
789D 1620      01610      LD      A,16H    ; INTRPT
789E 1620      01620      LD      A,16H    ; INTRPT
789F 1620      01630      LD      A,16H    ; INTRPT
78A0 1620      01640      LD      A,16H    ; INTRPT
78A1 1620      01650      LD      A,16H    ; INTRPT
78A2 1620      01660      LD      A,16H    ; INTRPT
78A3 1620      01670      LD      A,16H    ; INTRPT
78A4 1620      01680      LD      A,16H    ; INTRPT
78A5 1620      01690      LD      A,16H    ; INTRPT
78A6 1620      01700      LD      A,16H    ; INTRPT
78A7 1620      01710      LD      A,16H    ; INTRPT
78A8 1620      01720      LD      A,16H    ; INTRPT
78A9 1620      01730      LD      A,16H    ; INTRPT
78AA 1620      01740      LD      A,16H    ; INTRPT
78AB 1620      01750      LD      A,16H    ; INTRPT
78AC 1620      01760      LD      A,16H    ; INTRPT
78AD 1620      01770      LD      A,16H    ; INTRPT
78AE 1620      01780      LD      A,16H    ; INTRPT
78AF 1620      01790      LD      A,16H    ; INTRPT
78B0 1620      01800      LD      A,16H    ; INTRPT
78B1 1620      01810      LD      A,16H    ; INTRPT
78B2 1620      01820      LD      A,16H    ; INTRPT
78B3 1620      01830      LD      A,16H    ; INTRPT
78B4 1620      01840      LD      A,16H    ; INTRPT
78B5 1620      01850      LD      A,16H    ; INTRPT
78B6 1620      01860      LD      A,16H    ; INTRPT
78B7 1620      01870      LD      A,16H    ; INTRPT
78B8 1620      01880      LD      A,16H    ; INTRPT
78B9 1620      01890      LD      A,16H    ; INTRPT
78BA 1620      01900      LD      A,16H    ; INTRPT
78BB 1620      01910      LD      A,16H    ; INTRPT
78BC 1620      01920      LD      A,16H    ; INTRPT
78BD 1620      01930      LD      A,16H    ; INTRPT
78BE 1620      01940      LD      A,16H    ; INTRPT
78BF 1620      01950      LD      A,16H    ; INTRPT
78C0 1620      01960      LD      A,16H    ; INTRPT
78C1 1620      01970      LD      A,16H    ; INTRPT
78C2 1620      01980      LD      A,16H    ; INTRPT
78C3 1620      01990      LD      A,16H    ; INTRPT
78C4 1620      02000      LD      A,16H    ; INTRPT
78C5 1620      02010      LD      A,16H    ; INTRPT
78C6 1620      02020      LD      A,16H    ; INTRPT
78C7 1620      02030      LD      A,16H    ; INTRPT
78C8 1620      02040      LD      A,16H    ; INTRPT
78C9 1620      02050      LD      A,16H    ; INTRPT
78CA 1620      02060      LD      A,16H    ; INTRPT
78CB 1620      02070      LD      A,16H    ; INTRPT
78CC 1620      02080      LD      A,16H    ; INTRPT
78CD 1620      02090      LD      A,16H    ; INTRPT
78CE 1620      02100      LD      A,16H    ; INTRPT
78CF 1620      02110      LD      A,16H    ; INTRPT
78D0 1620      02120      LD      A,16H    ; INTRPT
78D1 1620      02130      LD      A,16H    ; INTRPT
78D2 1620      02140      LD      A,16H    ; INTRPT
78D3 1620      02150      LD      A,16H    ; INTRPT
78D4 1620      02160      LD      A,16H    ; INTRPT
78D5 1620      02170      LD      A,16H    ; INTRPT
78D6 1620      02180      LD      A,16H    ; INTRPT
78D7 1620      02190      LD      A,16H    ; INTRPT
78D8 1620      02200      LD      A,16H    ; INTRPT
78D9 1620      02210      LD      A,16H    ; INTRPT
78DA 1620      02220      LD      A,16H    ; INTRPT
78DB 1620      02230      LD      A,16H    ; INTRPT
78DC 1620      02240      LD      A,16H    ; INTRPT
78DD 1620      02250      LD      A,16H    ; INTRPT
78DE 1620      02260      LD      A,16H    ; INTRPT
78DF 1620      02270      LD      A,16H    ; INTRPT
78E0 1620      02280      LD      A,16H    ; INTRPT
78E1 1620      02290      LD      A,16H    ; INTRPT
78E2 1620      02300      LD      A,16H    ; INTRPT
78E3 1620      02310      LD      A,16H    ; INTRPT
78E4 1620      02320      LD      A,16H    ; INTRPT
78E5 1620      02330      LD      A,16H    ; INTRPT
78E6 1620      02340      LD      A,16H    ; INTRPT
78E7 1620      02350      LD      A,16H    ; INTRPT
78E8 1620      02360      LD      A,16H    ; INTRPT
78E9 1620      02370      LD      A,16H    ; INTRPT
78EA 1620      02380      LD      A,16H    ; INTRPT
78EB 1620      02390      LD      A,16H    ; INTRPT
78EC 1620      02400      LD      A,16H    ; INTRPT
78ED 1620      02410      LD      A,16H    ; INTRPT
78EE 1620      02420      LD      A,16H    ; INTRPT
78EF 1620      02430      LD      A,16H    ; INTRPT
78F0 1620      02440      LD      A,16H    ; INTRPT
78F1 1620      02450      LD      A,16H    ; INTRPT
78F2 1620      02460      LD      A,16H    ; INTRPT
78F3 1620      02470      LD      A,16H    ; INTRPT
78F4 1620      02480      LD      A,16H    ; INTRPT
78F5 1620      02490      LD      A,16H    ; INTRPT
78F6 1620      02500      LD      A,16H    ; INTRPT
78F7 1620      02510      LD      A,16H    ; INTRPT
78F8 1620      02520      LD      A,16H    ; INTRPT
78F9 1620      02530      LD      A,16H    ; INTRPT
78FA 1620      02540      LD      A,16H    ; INTRPT
78FB 1620      02550      LD      A,16H    ; INTRPT
78FC 1620      02560      LD      A,16H    ; INTRPT
78FD 1620      02570      LD      A,16H    ; INTRPT
78FE 1620      02580      LD      A,16H    ; INTRPT
78FF 1620      02590      LD      A,16H    ; INTRPT
7900 1620      02600      LD      A,16H    ; INTRPT
7901 1620      02610      LD      A,16H    ; INTRPT
7902 1620      02620      LD      A,16H    ; INTRPT
7903 1620      02630      LD      A,16H    ; INTRPT
7904 1620      02640      LD      A,16H    ; INTRPT
7905 1620      02650      LD      A,16H    ; INTRPT
7906 1620      02660      LD      A,16H    ; INTRPT
7907 1620      02670      LD      A,16H    ; INTRPT
7908 1620      02680      LD      A,16H    ; INTRPT
7909 1620      02690      LD      A,16H    ; INTRPT
790A 1620      02700      LD      A,16H    ; INTRPT
790B 1620      02710      LD      A,16H    ; INTRPT
790C 1620      02720      LD      A,16H    ; INTRPT
790D 1620      02730      LD      A,16H    ; INTRPT
790E 1620      02740      LD      A,16H    ; INTRPT
790F 1620      02750      LD      A,16H    ; INTRPT
7910 1620      02760      LD      A,16H    ; INTRPT
7911 1620      02770      LD      A,16H    ; INTRPT
7912 1620      02780      LD      A,16H    ; INTRPT
7913 1620      02790      LD      A,16H    ; INTRPT
7914 1620      02800      LD      A,16H    ; INTRPT
7915 1620      02810      LD      A,16H    ; INTRPT
7916 1620      02820      LD      A,16H    ; INTRPT
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7918 1620      02840      LD      A,16H    ; INTRPT
7919 1620      02850      LD      A,16H    ; INTRPT
791A 1620      02860      LD      A,16H    ; INTRPT
791B 1620      02870      LD      A,16H    ; INTRPT
791C 1620      02880      LD      A,16H    ; INTRPT
791D 1620      02890      LD      A,16H    ; INTRPT
791E 1620      02900      LD      A,16H    ; INTRPT
791F 1620      02910      LD      A,16H    ; INTRPT
7920 1620      02920      LD      A,16H    ; INTRPT
7921 1620      02930      LD      A,16H    ; INTRPT
7922 1620      02940      LD      A,16H    ; INTRPT
7923 1620      02950      LD      A,16H    ; INTRPT
7924 1620      02960      LD      A,16H    ; INTRPT
7925 1620      02970      LD      A,16H    ; INTRPT
7926 1620      02980      LD      A,16H    ; INTRPT
7927 1620      02990      LD      A,16H    ; INTRPT
7928 1620      03000      LD      A,16H    ; INTRPT
7929 1620      03010      LD      A,16H    ; INTRPT
792A 1620      03020      LD      A,16H    ; INTRPT
792B 1620      03030      LD      A,16H    ; INTRPT
792C 1620      03040      LD      A,16H    ; INTRPT
792D 1620      03050      LD      A,16H    ; INTRPT
792E 1620      03060      LD      A,16H    ; INTRPT
792F 1620      03070      LD      A,16H    ; INTRPT
7930 1620      03080      LD      A,16H    ; INTRPT
7931 1620      03090      LD      A,16H    ; INTRPT
7932 1620      03100      LD      A,16H    ; INTRPT
7933 1620      03110      LD      A,16H    ; INTRPT
7934 1620      03120      LD      A,16H    ; INTRPT
7935 1620      03130      LD      A,16H    ; INTRPT
7936 1620      03140      LD      A,16H    ; INTRPT
7937 1620      03150      LD      A,16H    ; INTRPT
7938 1620      03160      LD      A,16H    ; INTRPT
7939 1620      03170      LD      A,16H    ; INTRPT
793A 1620      03180      LD      A,16H    ; INTRPT
793B 1620      03190      LD      A,16H    ; INTRPT
793C 1620      03200      LD      A,16H    ; INTRPT
793D 1620      03210      LD      A,16H    ; INTRPT
793E 1620      03220      LD      A,16H    ; INTRPT
793F 1620      03230      LD      A,16H    ; INTRPT
7940 1620      03240      LD      A,16H    ; INTRPT
7941 1620      03250      LD      A,16H    ; INTRPT
7942 1620      03260      LD      A,16H    ; INTRPT
7943 1620      03270      LD      A,16H    ; INTRPT
7944 1620      03280      LD      A,16H    ; INTRPT
7945 1620      03290      LD      A,16H    ; INTRPT
7946 1620      03300      LD      A,16H    ; INTRPT
7947 1620      03310      LD      A,16H    ; INTRPT
7948 1620      03320      LD      A,16H    ; INTRPT
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794A 1620      03340      LD      A,16H    ; INTRPT
794B 1620      03350      LD      A,16H    ; INTRPT
794C 1620      03360      LD      A,16H    ; INTRPT
794D 1620      03370      LD      A,16H    ; INTRPT
794E 1620      03380      LD      A,16H    ; INTRPT
794F 1620      03390      LD      A,16H    ; INTRPT
7950 1620      03400      LD      A,16H    ; INTRPT
7951 1620      03410      LD      A,16H    ; INTRPT
7952 1620      03420      LD      A,16H    ; INTRPT
7953 1620      03430      LD      A,16H    ; INTRPT
7954 1620      03440      LD      A,16H    ; INTRPT
7955 1620      03450      LD      A,16H    ; INTRPT
7956 1620      03460      LD      A,16H    ; INTRPT
7957 1620      03470      LD      A,16H    ; INTRPT
7958 1620      03480      LD      A,16H    ; INTRPT
7959 1620      03490      LD      A,16H    ; INTRPT
795A 1620      03500      LD      A,16H    ; INTRPT
795B 1620      03510      LD      A,16H    ; INTRPT
795C 1620      03520      LD      A,16H    ; INTRPT
795D 1620      03530      LD      A,16H    ; INTRPT
795E 1620      03540      LD      A,16H    ; INTRPT
795F 1620      03550      LD      A,16H    ; INTRPT
7960 1620      03560      LD      A,16H    ; INTRPT
7961 1620      03570      LD      A,16H    ; INTRPT
7962 1620      03580      LD      A,16H    ; INTRPT
7963 1620      03590      LD      A,16H    ; INTRPT
7964 1620      03600      LD      A,16H    ; INTRPT
7965 1620      03610      LD      A,16H    ; INTRPT
7966 1620      03620      LD      A,16H    ; INTRPT
7967 1620      03630      LD      A,16H    ; INTRPT
7968 1620      03640      LD      A,16H    ; INTRPT
7969 1620      03650      LD      A,16H    ; INTRPT
796A 1620      03660      LD      A,16H    ; INTRPT
796B 1620      03670      LD      A,16H    ; INTRPT
796C 1620      03680      LD      A,16H    ; INTRPT
796D 1620      03690      LD      A,16H    ; INTRPT
796E 1620      03700      LD      A,16H    ; INTRPT
796F 1620      03710      LD      A,16H    ; INTRPT
7970 1620      03720      LD      A,16H    ; INTRPT
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7975 1620      03770      LD      A,16H    ; INTRPT
7976 1620      03780      LD      A,16H    ; INTRPT
7977 1620      03790      LD      A,16H    ; INTRPT
7978 1620      03800      LD      A,16H    ; INTRPT
7979 1620      03810      LD      A,16H    ; INTRPT
797A 1620      03820      LD      A,16H    ; INTRPT
797B 1620      03830      LD      A,16H    ; INTRPT
797C 1620      03840      LD      A,16H    ; INTRPT
797D 1620      03850      LD      A,16H    ; INTRPT
797E 1620      03860      LD      A,16H    ; INTRPT
797F 1620      03870      LD      A,16H    ; INTRPT
7980 1620      03880      LD      A,16H    ; INTRPT
7981 1620      03890      LD      A,16H    ; INTRPT
7982 1620      03900      LD      A,16H    ; INTRPT
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7984 1620      03920      LD      A,16H    ; INTRPT
7985 1620      03930      LD      A,16H    ; INTRPT
7986 1620      03940      LD      A,16H    ; INTRPT
7987 1620      03950      LD      A,16H    ; INTRPT
7988 1620      03960      LD      A,16H    ; INTRPT
7989 1620      03970      LD      A,16H    ; INTRPT
798A 1620      03980      LD      A,16H    ; INTRPT
798B 1620      03990      LD      A,16H    ; INTRPT
798C 1620      04000      LD      A,16H    ; INTRPT
798D 1620      04010      LD      A,16H    ; INTRPT
798E 1620      04020      LD      A,16H    ; INTRPT
798F 1620      04030      LD      A,16H    ; INTRPT
7990 1620      04040      LD      A,16H    ; INTRPT
7991 1620      04050      LD      A,16H    ; INTRPT
7992 1620      04060      LD      A,16H    ; INTRPT
7993 1620      04070      LD      A,16H    ; INTRPT
7994 1620      04080      LD      A,16H    ; INTRPT
7995 1620      04090      LD      A,16H    ; INTRPT
7996 1620      04100      LD      A,16H    ; INTRPT
7997 1620      04110      LD      A,16H    ; INTRPT
7998 1620      04120      LD      A,16H    ; INTRPT
7999 1620      04130      LD      A,16H    ; INTRPT
799A 1620      04140      LD      A,16H    ; INTRPT
799B 1620      04150      LD      A,16H    ; INTRPT
799C 1620      04160      LD      A,16H    ; INTRPT
799D 1620      04170      LD      A,16H    ; INTRPT
799E 1620      04180      LD      A,16H    ; INTRPT
799F 1620      04190      LD      A,16H    ; INTRPT
79A0 1620      04200      LD      A,16H    ; INTRPT
79A1 1620      04210      LD      A,16H    ; INTRPT
79A2 1620      04220      LD      A,16H    ; INTRPT
79A3 1620      04230      LD      A,16H    ; INTRPT
79A4 1620      04240      LD      A,16H    ; INTRPT
79A5 1620      04250      LD      A,16H    ; INTRPT
79A6 1620      04260      LD      A,16H    ; INTRPT
79A7 1620      04270      LD      A,16H    ; INTRPT
79A8 1620      04280      LD      A,16H    ; INTRPT
79A9 1620      04290      LD      A,16H    ; INTRPT
79AA 1620      04300      LD      A,16H    ; INTRPT
79AB 1620      04310      LD      A,16H    ; INTRPT
79AC 1620      04320      LD      A,16H    ; INTRPT
79AD 1620      04330      LD      A,16H    ; INTRPT
79AE 1620      04340      LD      A,16H    ; INTRPT
79AF 1620      04350      LD      A,16H    ; INTRPT
79B0 1620      04360      LD      A,16H    ; INTRPT
79B1 1620      04370      LD      A,16H    ; INTRPT
79B2 1620      04380      LD      A,16H    ; INTRPT
79B3 1620      04390      LD      A,16H    ; INTRPT
79B4 1620      04400      LD      A,16H    ; INTRPT
79B5 1620      04410      LD      A,16H    ; INTRPT
79B6 1620      04420      LD      A,16H    ; INTRPT
79B7 1620      04430      LD      A,16H    ; INTRPT
79B8 1620      04440      LD      A,16H    ; INTRPT
79B9 1620      04450      LD      A,16H    ; INTRPT
79BA 1620      04460      LD      A,16H    ; INTRPT
79BB 1620      04470      LD      A,16H    ; INTRPT
79BC 1620      04480      LD      A,16H    ; INTRPT
79BD 1620      04490      LD      A,16H    ; INTRPT
79BE 1620      04500      LD      A,16H    ; INTRPT
79BF 1620      04510      LD      A,16H    ; INTRPT
79C0 1620      04520      LD      A,16H    ; INTRPT
79C1 1620      04530      LD      A,16H    ; INTRPT
79C2 1620      04540      LD      A,16H    ; INTRPT
79C3 1620      04550      LD      A,16H    ; INTRPT
79C4 1620      04560      LD      A,16H    ; INTRPT
79C5 1620      04570      LD      A,16H    ; INTRPT
79C6 1620      04580      LD      A,16H    ; INTRPT
79C7 1620      04590      LD      A,16H    ; INTRPT
79C8 1620      04600      LD      A,16H    ; INTRPT
79C9 1620      04610      LD      A,16H    ; INTRPT
79CA 1620      04620      LD      A,16H    ; INTRPT
79CB 1620      04630      LD      A,16H    ; INTRPT
79CC 1620      04640      LD      A,16H    ; INTRPT
79CD 1620      04650      LD      A,16H    ; INTRPT
79CE 1620      04660      LD      A,16H    ; INTRPT
79CF 1620      04670      LD      A,16H    ; INTRPT
79D0 1620      04680      LD      A,16H    ; INTRPT
79D1 1620      04690      LD      A,16H    ; INTRPT
79D2 1620      04700      LD      A,16H    ; INTRPT
79D3 1620      04710      LD      A,16H    ; INTRPT
79D4 1620      04720      LD      A,16H    ; INTRPT
79D5 1620      04730      LD      A,16H    ; INTRPT
79D6 1620      04740      LD      A,16H    ; INTRPT
79D7 1620      04750      LD      A,16H    ; INTRPT
79D8 1620      04760      LD      A,16H    ; INTRPT
79D9 1620      04770      LD      A,16H    ; INTRPT
79DA 1620      04780      LD      A,16H    ; INTRPT
79DB 1620      04790      LD      A,16H    ; INTRPT
79DC 1620      04800      LD      A,16H    ; INTRPT
79DD 1620      04810      LD      A,16H    ; INTRPT
79DE 1620      04820      LD      A,16H    ; INTRPT
79DF 1620      04830      LD      A,16H    ; INTRPT
79E0 1620      04840      LD      A,16H    ; INTRPT
79E1 1620      04850      LD      A,16H    ; INTRPT
79E2 1620      04860      LD      A,16H    ; INTRPT
79E3 1620      04870      LD      A,16H    ; INTRPT
79E4 1620      04880      LD      A,16H    ; INTRPT
79E5 1620      04890      LD      A,16H    ; INTRPT
79E6 1620      04900      LD      A,16H    ; INTRPT
79E7 1620      04910      LD      A,16H    ; INTRPT
79E8 1620      04920      LD      A,16H    ; INTRPT
79E9 1620      04930      LD      A,16H    ; INTRPT
79EA 1620      04940      LD      A,16H    ; INTRPT
79EB 1620      04950      LD      A,16H    ; INTRPT
79EC 1620      04960      LD      A,16H    ; INTRPT
79ED 1620      04970      LD      A,16H    ; INTRPT
79EE 1620      04980      LD      A,16H    ; INTRPT
79EF 1620      04990      LD      A,16H    ; INTRPT
79F0 1620      05000      LD      A,16H    ; INTRPT
79F1 1620      05010      LD      A,16H    ; INTRPT
79F2 1620      05020      LD      A,16H    ; INTRPT
79F3 1620      05030      LD      A,16H    ; INTRPT
79F4 1620      05040      LD      A,16H    ; INTRPT
79F5 1620      05050      LD      A,16H    ; INTRPT
79F6 1620      05060      LD      A,16H    ; INTRPT
79F7 1620      05070      LD      A,16H    ; INTRPT
79F8 1620      05080      LD      A,16H    ; INTRPT
79F9 1620      05090      LD      A,16H    ; INTRPT
79FA 1620      05100      LD      A,16H    ; INTRPT
79FB 1620      05110      LD      A,16H    ; INTRPT
79FC 1620      05120      LD      A,16H    ; INTRPT
79FD 1620      05130      LD      A,16H    ; INTRPT
79FE 1620      05140      LD      A,16H    ; INTRPT
79FF 1620      05150      LD      A,16H    ; INTRPT
7A00 1620      05160      LD      A,16H    ; INTRPT
7A01 1620      05170      LD      A,16H    ; INTRPT
7A02 1620      05180      LD      A,
```

PROJECT 80

If the interrupt was found to occur from the 8259A, the count variable is cleared (to count four more interrupts) and the LED display is updated by 1. The service routine then finishes by re-starting the 8253 timer and sending the EOI to the 8259A.

Conclusion

The 8259A interrupt controller provides more capability and flexibility than described here. If you are interested in some of the more advanced applications of the device, you should get a copy of the data sheet from Intel Corporation. Since the G.P. I/O board project also comes in CMOS (which may be important to some of you), the 8259A is available in CMOS from the same sources. ■

1983 Intel Microprocessor and Peripheral Handbook

Intel Corporation
Literature Department
3065 Bowers Avenue
Santa Clara, CA 95051

Zilog 1981 Data Book

Zilog, Inc.
10340 Bubb Road
Cupertino, CA 95014

1982/83 Mostek Z80 Designer's Guide

Mostek Corporation
1215 West Crosby Rd.
Carrollton, Texas 75006

Write to Roger C. Alford at Wash-
tenaw Digital Systems, P.O. Box
2014, Ann Arbor, MI 48106.

Quantity	Description	Distributor	Part Number	Price
1	8259A Programmable interrupt controller IC	JDR	8259	6.90
1	7416 Hex inverter/drivers (O.C.)(TTL) IC	JDR	7416	.25
1	74LS04 Hex inverter (LS TTL) IC*	JDR	74LS04	.24
1	74LS138 3-to-8 decoder IC*	JDR	74LS138	.55
1	74LS32 Quad 2-input OR gate (LS TTL) IC†	JDR	74LS32	.29
1	100 µF/35 V electrolytic capacitor (PC mount)*	RS	272-1028	.79
1	.1 µF/50 V disc capacitor*	RS	272-135	.25
6	1k ohm resistor (¼ watt)‡	RS	271-1321	.08
1	74LS74 Dual D-type flip-flop(LS TTL) IC§	JDR	74LS74	.35
1	8 pos. terminal block*	RS	274-687	1.89
1	2 pos. terminal block*	RS	274-656	.60
1	.1" matrix grid prototype board	RS	276-158	1.95
1	40 pos. cable header (W/W)Ω	DK	R241-ND	5.58
1	40 pos. ribbon cable edge connector Ω	DK	R503-ND	3.80
1	40 pos. ribbon cable socket connector	DK	R306-ND	3.73
1 ft.	40 cond. ribbon cable Ω	DK	R007-ND	0.00
1	50 pos. cable header (W/W)π	DK	R247-ND	6.93
1	50 pos. ribbon cable edge connector π	RS	276-1566	4.95
1	50 pos. ribbon cable socket connection π	DK	R307-ND	4.65
1 ft.	50 cond. ribbon cable π	DK	R008-ND	0.00

* Stand-alone board only.

† Reset circuitry use and Model III/4 required.

‡ One less required for general-purpose I/O board addition. Two less required if reset circuitry not implemented.

§ Use with reset circuitry only.

Ω Model I only.

π Models III/4 only.

Addresses:

JDR Microdevices, 1224 S. Bascom Ave., San Jose, CA 95128, 800-538-500 or 408-995-5430 outside California; 800-662-6279 within California.

Radio Shack (RS) National Parts Division, 900 East Northside Drive, Fort Worth, TX 76102, 817-870-5662.

Digi-Key Corp. (DK), Highway 32 S., P.O. Box 677, Thief River Falls, MN 56701, 800-346-5144 or 218-681-6674.

Table 1. Parts list and ordering information.

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- Compare daily diet to individual RDA Chart
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- Plan varied daily menus based on sound nutrition
- Save records of daily meals and menus for future planning
- Print nutrition charts, food, meal, menu and grocery lists

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MAIN Program Menu

- (1) Recommended Daily Dietary Allowance (RDA) CHART
- (2) 733 Expandable Random Access FOOD LIST Data File
- (3) 28 Nutritional MEAL LIST Data File Examples
- (4) 7 Balanced DAILY MENU LIST Data File Examples
- (5) GROCERY LIST Program Module
- (6) 25 Page USER'S MANUAL including Charts and Tables

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
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CB5629 10 ft. 25 pin standard RS-232 (fully loaded)	25.00
CB5620 6 ft. parallel for TRS 80 Model I-III-IV	22.00
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Ultra Term Version 2 is the most powerful communications programs available for the TRS-80. The package includes a full featured terminal program, a self relocating host program and hex conversion utilities for bulletin board downloading, all at prices for lower than competing programs with less features. Ultra Term features include: Ultra Term supports auto dial modems with an easy to use dial menu capable of supporting any modem that accepts dial commands from the RS-232 port or by pulses on the RTS line or cassette port, including the Radio Shack Modem 2, Hayes Smartmodem, or the Lynx auto dial. Ultra Term Version 2 is the only terminal program for the TRS-80 that has a true prompt controlled auto logon feature. This feature, when used in conjunction with our auto dial feature allows the user to issue a single command to select a number to dial, set RS-232 parameters, dial the number, wait for prompts from the system being called, and answer multiple questions to sign the user onto the system being called. No other TRS-80 terminal program available offers this power and versatility. Ultra Term is the only program that offers a direct to disk file transfer mode that allows full control from the transmitting computer, and unattended operation at the receiving computer. This gives you the ability to transfer multiple files or an entire disk with no one present at the receiving computer. Ultra Term has an exclusive split screen feature that allows simultaneous two way communications from terminal mode and supports line printers with a 1K print buffer. Ultra Terms universal ASCII format file transmission supports delays between characters or between lines, as well as prompt controlled transmission for compatibility with virtually all systems. A counter continuously displays the amount of free memory remaining whenever the buffer is in use. Ultra Term will run on a Model 1 or Model 3 TRS-80 disk system with any TRSDOS compatible operating system (RS-232 and Modem required).

Ultra Term Version 2 retail price \$79.95

Upgrade for current Ultra Term Version 1 owners \$24.95 (For Upgrade, you must return your original version 1 disk.)

INFOEX-80 BULLETIN BOARD SYSTEM

The INFORMATION EXchange bulletin board program contains all the software necessary to set up your own bulletin board service or message center. The Infoex-80 software automatically answers phone calls, displays a logon message or bulletin, allows callers to enter and retrieve messages, and lets users chat (type) directly to the system operator. Infoex-80 supports uploading and downloading in both universal ASCII format and Ultra Term disk file transfer format for accurate and fast file transfer. Infoex-80 allows users to apply for individual passwords, so private password protected messages can be left for any user. The system also keeps track of the number of times each user has accessed the system, as well as the highest message each user has read, and advises each user when messages have been left for them. The program requires a TRS-80 Model 3 (or Model 1 with double density adapter), 2 disk drives, 48K ram, RS-232 interface, any auto-answer modem and a DOS that supports the CMD "doscmd" from BASIC (Any DOS but TRSDOS).

211

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Fast Impressions

The Fastext-80 bidirectional dot-matrix printer (\$259) gives you 80 characters per second (cps) print speed at 10 characters per inch (cpi), and features a line buffer and six-pitch capability.

Fastext-80 also features a self-test switch, an 80-character print line, emphasized or elongated print, and bit-image graphics.

Pitches include pica, elite, condensed, and enlarged printing. The printer supports the 96-character ASCII set and can print in seven languages.

Its drop-in cassette ribbon has a life of one million characters. Fastext-80 comes with friction feed and a Centronics parallel interface. A tractor feed is also available.

For more information contact Smith-Corona at 65 Locust Ave., New Canaan, CT 06840, 203-972-1471.

Reader Service ✓ 563

Running with IBM

Xcalibur, from Micro Projects Engineering Inc. (3951 Higuera St., Suite B, Culver City, CA 90230, 213-202-1865), lets you run IBM PC software on the Models I, III, 4, and 4P.

This enhancement board gives you PC compatibility to run MS-DOS 2.11, MultiMate, dBase II, WordStar, MultiPlan, and other popular IBM PC software packages. Add a monochrome monitor card (\$199.95) and



The Fastext 80 dot-matrix printer prints seven languages in six type fonts.

128K RAM (\$198) and you can run Lotus 1-2-3.

Xcalibur comes with an IBM-compatible bus connector for use with IBM expansion cards and MS-DOS. It installs easily through cable connections inside your computer.

The Xcalibur board is \$495, and includes an MS-DOS disk. Additional RAM chips and other upgrade hardware are also available.

Reader Service ✓ 552

Adventures In Pixieland

Pixie Quest, from Seal Software (4 White Birch Court, Turnersville, NJ 08012, 609-228-6169), is a Model I adventure game that leads you and your companions on a trip through the forbidden wood of Balmar and the caves of the evil sorcerer, Tralon.

Your goal is to return pixies Frolic and Pixel to the

village of Brahlee. Along the way you'll find treasures, puzzles, and meet jabowockies, ogres, and evil gremlins.

The game's parallel paths through the woods mean that failure to solve a puzzle won't leave you at a dead end. Ultimately, however, you must cope with every predicament using ingenuity, imagination, and whatever you find on your journey.

Pixie Quest (\$34.95) requires 48K RAM and one drive.

Reader Service ✓ 553

Programming for Fun

When you're tired of working with your TRS-80, *101 Programming Surprises & Tricks for Your TRS-80 Computer* (\$10.95) gives you games, novelties, and techniques to make computing fun again.

This strictly-for-fun programming guide includes

music and sound programs, animation programs, one- and two-player games, and programming tricks useful for more serious programming applications.

If typing in listings cramps your style, a disk that includes all the programs is available for \$19.95.

For more information contact Tab Books Inc., Blue Ridge Summit, PA 17214, 717-794-2191.

Reader Service ✓ 554

Model 100 Means Business

Business Finance (\$39.95) is Tandy Corp.'s 12-program financial analysis package for the Model 100. Calculation programs calculate net present value, internal rate of return, financial management rate of return, and depreciation.

Also included are analysis programs for rent or purchase decisions, lease/purchase analysis, machinery replacement, and bond analysis.

An annuity/annuity-due program does calculations for savings accounts, compound interest, annuities, leases, loans, financial modeling, and other investments.

The portfolio analysis program generates a series of portfolio distributions to minimize risk for a given rate of return or maximize return for a given risk.

Business Finance requires 16K RAM and is available from Radio Shack stores.

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Disc mapping	included	not available	*
Total Cost	\$169.95	Total Cost	\$279.00

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NEW PRODUCTS

For more information contact Tandy Corp./Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

Reader Service ✓ 556

Computer Card Game

Casino, the card game, is now a computer game. You play against your Model I, III, or 4, as it keeps score, shuffles the cards, and plays dealer.

The game includes an instruction manual with sections on rules of the game and playing strategy. Casino is available on 16K cassette (\$12.95) or 32K disk (\$16.95). Contact Dynacomp (Catalog Dept., P.O. Box 18129, Rochester, NY 14618, 716-442-8960) for more details.

Reader Service ✓ 557



Workstation 100 makes using your Model 100 easier.

Portable Accessories

The Workstation 100 kit (\$45.95) contains six attachments (also available separately) to make your Model 100 more efficient.

The Power-100 (\$29.95) is a rechargeable battery pack that powers the Model 100 for 9-12 hours. Support legs (\$3.95) angle the Model 100 for easier typing.

The kit also includes a clip-folder typing stand (\$7.55), a pen (\$2.75), a mechanical pencil (\$1.75), and a battery case (\$3.95). Attachments are compact enough to fit into the Model 100 carrying case.

Contact A.R.M.S. (12131 Old Buckingham Road, Midlothian, VA 23113, 804-794-6675) for more information.

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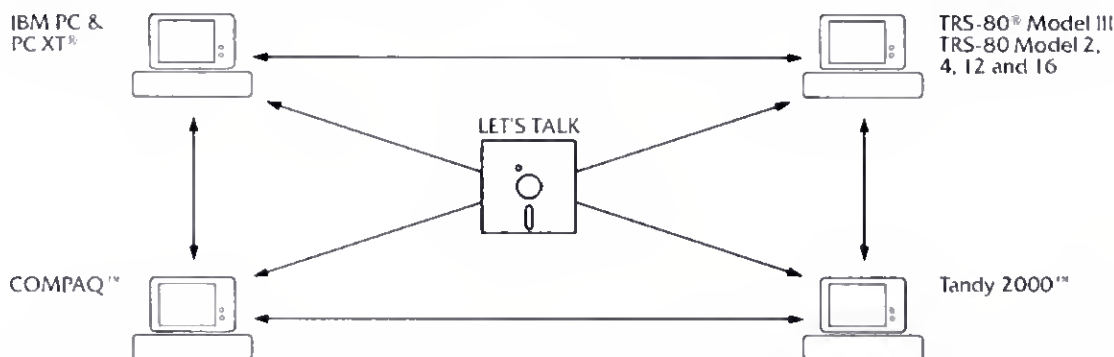
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NEW PRODUCTS

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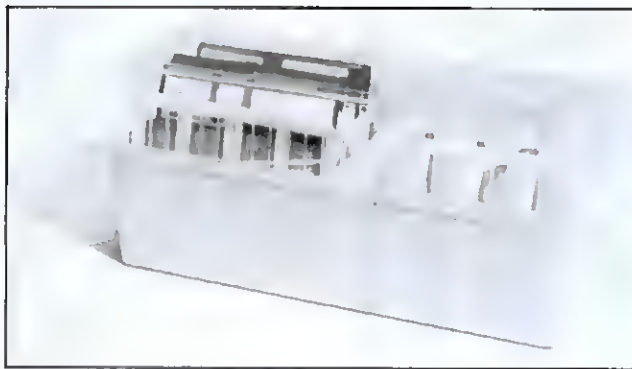
The program displays each tax form. You enter the data, and Tax Commissioner computes and prints out the tax return. You can print data only, or choose from more than 35 pre-printed forms.

Tax Commissioner requires a Model 2000, or a Model III/4 with CP/M 2.2. Contact TAXbyte Inc., 3803 28th St., Moline, IL 61265, 309-764-7245 for more information.

Reader Service ✓ 567

Super for the Model 4

Super, the data base management system from the Institute for Scientific Analysis Inc., is available



Soho Corp.'s stackable disk boxes are \$4 each.

for the Model 4. Super 2.3 is menu-driven, and features on-screen editing, a calculator program, and a filing system.

The program lets you set up and create data bases, save report formats, print reports, and sort information. Super 2.3 is available for the Models I, II, and III. It costs \$199 and includes a manual. The program is also

available as an upgrade.

For more information contact Institute for Scientific Analysis Inc. at 36 E. Baltimore Pike, Suite 106A, Media, PA 19063.

Reader Service ✓ 564

Disk Boxing

The D-60 compact disk storage box (\$4) from Soho

Corp. stores up to 60 5 1/4-inch disks.

It features a smoke-tint see-through cover and has four plastic dividers for organizing disks. Disk boxes stack for easy storage. For more information contact Soho Corp. at P.O. Box 20081, Ferndale, MI 48220, 313-543-5209.

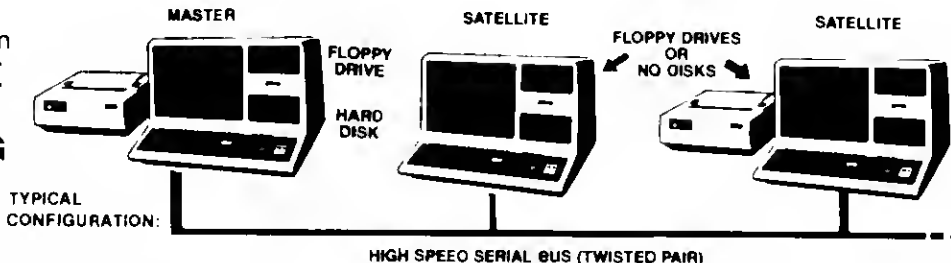
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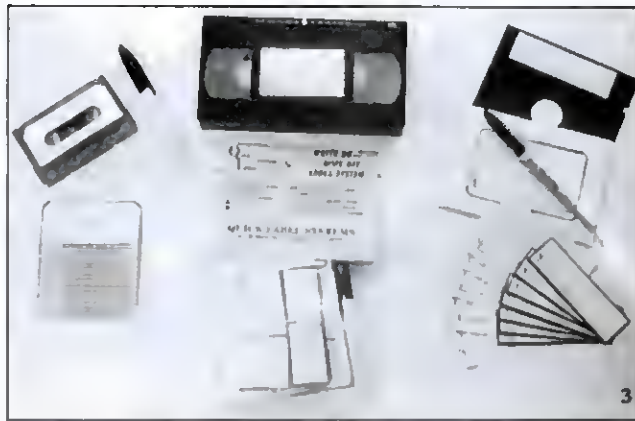
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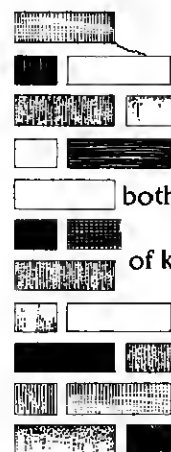


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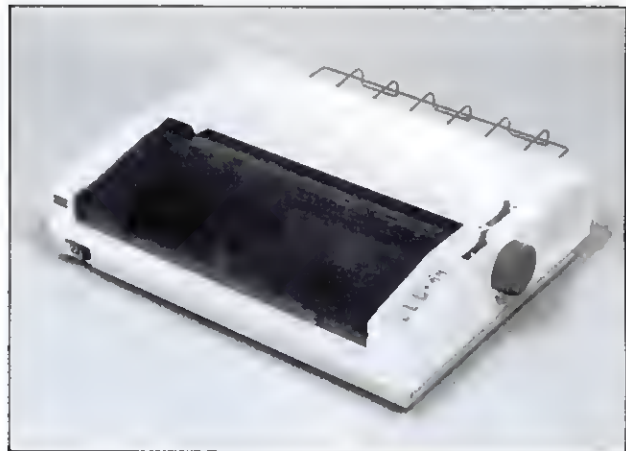


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Fujitsu Ink

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The printer features friction and tractor feeds, automatic perforation skip, 255 character fonts, and a language-select function. It prints international characters, superscripts, subscripts, and images.

The DPMG9 weighs 19 lbs. and measures 12 by 16 by 4 inches. A Centronics interface is standard, with RS-232 interfacing available.

For more information contact Fujitsu America Inc. at 3055 Orchard Drive, San Jose, CA 95134, 408-946-8777.

Reader Service ✓ 561

Write the Volks

Volkswriter Deluxe (\$295), the popular word processor for the IBM PC, is available for the Models 1200 and 2000.

Features include foreign-language and scientific character sets, on-screen tutorials, multiple fonts and colors, and compatibility with Lotus 1-2-3, VisiCalc, and other commercial spread-

sheet programs.

Volkswriter Deluxe for the Model 2000 takes advantage of the Model 2000's extra memory, faster processing speed, and color capabilities.

Minimum system requirements are 128K RAM and two drives. Volkswriter is available through Radio Shack stores. Contact Life-tree Software Inc. (411 Pacific St., Monterey, CA 93940, 408-373-4718) for more information.

Reader Service ✓ 568

Tenant Fever

Good Software Corp. (12900 Preston Road, Dallas, TX 75230, 214-239-6085) has announced the Real Estate Investor III package for the Models 1000, 1200, and 2000.

Investor III (\$249) uses your criteria to analyze real estate investment potential, and generates profit projections for potential investments. Projections range up to 20 years for more than a dozen financial criteria. Tax formulas are based on 1985 tax laws.

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The Volksmodem 12 features control from any Hayes-compatible program, with tone or pulse dialing.

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Reader Service ✓ 558

It's a Volksmodem

The Volksmodem 12 300-/1,200-baud intelligent modem (\$299) features auto dial/auto answer, tone and pulse dialing, busy signal detection, dial tone detection, and telephone set jack.

The unit works with any Hayes-compatible programs. It includes a voice/data switch, two modem configuration switches, status indicator lights, and five programmable set registers. A 12-volt ac adapter is also included.

Contact Anchor Automation (6913 Valjean Ave., Van Nuys, CA 91406, 818-997-7758) for more information.

Reader Service ✓ 562

Stellar Words

The WordStar word processor program, WordStar

Professional Options package, and WordStar Professional package are available for the Models 1200 and 2000.

WordStar (\$495) features self-help menus, block moves, global word search, justification, and formatting. Print options include boldface, underline, double strike, overprint, superscript and subscript.

WordStar Professional Options package (\$345) contains three utility programs for WordStar. The MailMerge text merging utility creates form letters. CorrectStar checks spelling against three dictionary files (1,500-65,000 words).

StarIndex creates indexes, tables of contents, and lists of figures and tables automatically. Programs are also available separately.

The WordStar Professional (\$695) includes WordStar, MailMerge, CorrectStar, and StarIndex. For more details, contact Tandy Corp./Radio Shack at 1800 One Tandy Center, Fort Worth, TX 76102.

Reader Service ✓ 565

Able Enable

Enable (\$695), an integrated package for the Model 1200, includes word processing, a spreadsheet, graphics, database management, and telecommunications.

Modules offer fast, easy transfer of data. Enable integrates data from all modules in one window for printing or data transmission. You can create graphs from the spreadsheet or data base program, then insert the graphs, spreadsheet, and data base data into a word processing document on screen.

The system is compatible with files from dBaseII, Lotus 1-2-3, VisiCalc, WordStar, EasyWriter I, and Volkswriter. Enable also lets you use modules simultaneously. For instance, you can use the spreadsheet program, print a report, and receive stock quotes over the wire all at once.

Current owners of Lotus 1-2-3 can buy Enable for \$200, and dBase II users can buy it for \$400, with proof of purchase. For more information contact The Software Group at Northway Ten Executive Park, Ballston Lake, NY 12019, 800-338-4646.

Reader Service ✓ 572

PFS:Planning

Software Publishing Corp. (1901 Landings Drive, Mountain View, CA 94043, 415-962-8910) offers a full line of PFS: products, including its new PFS:Plan spreadsheet program for the Models 1200 and 2000.

PFS:Plan (\$140) lets you develop budgets, forecasts, and other financial models without learning complex program formulas and command sequences.

Quick entry keys let you generate row and column headings with one key-stroke. PFS:Plan displays formulas next to rows and above column headings in English terms.

PFS:Plan accepts files written with Lotus 1-2-3, Multiplan, or VisiCalc, and integrates with all other PFS: series programs.

Other PFS: series programs include the PFS: Write word processor (\$140), PFS:File information management program (\$140), PFS:Report report generator (\$125), PFS:Graph chart and graph program (\$140), PFS:Proof spelling checker (\$195), and PFS: Access communications program (\$195). PFS:File and PFS:Report are also available for the Models III, 4, and 2000.

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On-Line Health

Home Health Guide for Children (\$69.95) solves the problem of deciding when to call the doctor for your child by providing information on 155 health problems.

Dr. Barton D. Schmidt, a pediatrician, describes and defines symptoms and causes of illnesses, recommends action, home care, and preventive measures. Health problems covered range from diaper rash and mumps to common colds, selecting shoes, and emergency situations.

The three-disk Model 4 package features built-in instructions and a menu for easy use. It's available at Radio Shack stores. Contact Clinical Reference Systems (P.O. Box 20308, Denver, CO 80220, 800-821-2794) for more information.

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Sweetware Inc.'s newest microcomputer is getting its licks in the personal computer marketplace.

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For more information contact Sweetware Inc., 516 Shelburne Road, S. Burlington, VT 05401, 802-862-6939. Reader Service ✓ 569

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